SENECA III

PILOT'S INFORMATION MANUAL

Seneca III

PA-34-220T

HANDBOOK PART NO. 761 756

PIPER

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APPLICABILITY

Application of this handbook is limited to the specific Piper PA-34-220T model airplane designated by serial number and registration number on the face of the title page of this handbook.

This handbook cannot be used for operational purposes unless kept in a current status.

REVISIONS

The information compiled in the Pilot's Operating Handbook, with the exception of the equipment list, will be kept current by revisions distributed to the airplane owners. The equipment list was current at the time the airplane was licensed by the manufacturer and thereafter must be maintained by the owner.

Revision material will consist of information necessary to update the text of the present handbook and/or to add information to cover added airplane equipment.

I. Revisions

Revisions will be distributed whenever necessary as complete page replacements or additions and shall be inserted into the handbook in accordance with the instructions given below:

1. Revision pages will replace only pages with the same page number.
2. Insert all additional pages in proper numerical order within each section.
3. Page numbers followed by a small letter shall be inserted in direct sequence with the same common numbered page.

II. Identification of Revised Material

Revised text and illustrations shall be indicated by a black vertical line along the outside margin of the page, opposite revised, added or deleted material. A line along the outside margin of the page opposite the page number will indicate that an entire page was added.

Black lines will indicate only current revisions with changes and additions to or deletions of existing text and illustrations. Changes in capitalization, spelling, punctuation or the physical location of material on a page will not be identified.

ORIGINAL PAGES ISSUED

The original pages issued for this handbook prior to revision are given below:

Title, ii through vii, 1-1 through 1-11, 2-1 through 2-12, 3-1 through 3-23, 4-1 through 4-37, 5-1 through 5-31, 6-1 through 6-68, 7-1 through 7-39, 8-1 through 8-19, 9-1 through 9-102, and 10-1 through 10-3.

PILOT'S OPERATING HANDBOOK LOG OF REVISIONS

Current Revisions to the PA-34-220T Seneca III Pilot's Operating Handbook. REPORT: VB-1110 issued January 8, 1981.

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature and Date
Rev. 1 (PR810421)	3-4	Revised Warning.	
	3-15	Revised Warning.	
	4-9	Revised procedure.	
	4-26	Revised para. 4.31.	
	5-21	Revised fig. 5-21.	
	6-40	Added items 221 and 223.	
	6-48	Revised item 285.	
	6-49	Revised item 291.	
	7-14	Revised para. 7.15.	
	7-26	Revised para. 7.23.	
	9-i	Revised Table of Contents.	
	9-19 thru 9-32b	Added Supplement 4 (KFC 200 Automatic Flight Control System with Flight Director).	
	9-33 thru 9-44d	Added Suplement 5 (KFC 200 Automatic Flight Control System without Flight Director).	
	9-68	Revised sec. 4 (b) (1).	
	9-103 thru 9-106	Added Supplement 16 (Propeller Synchrophaser Installation).	
	9-107 thru 9-112	Added Supplement 17 (Century 21 Autopilot Installation).	
	9-113 thru 9-124	Added Supplement 18 (Century 41 Autopilot Installation).	Ward Evans Ward Evans April 21, 1981

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature and Date
Rev. 2 (PR810817)	3-4	Revised para. 3.3.	
	3-15	Revised para. 3.7.	
	4-i	Changed pg. nos.	
	4-ii	Changed pg. nos.	
	4-4	Revised para. 4.5.	
	4-5	Revised para. 4.5.	
	4-9	Revised para. 4.5.	
	4-10	Revised para. 4.5.	
	4-12	Revised para. 4.5.	
	4-15	Moved para. 4.11 to pg. 4-16.	
	4-16	Relocated para. 4.11 from pg. 4-15; moved info. to pg. 4-16a.	
	4-16a	New pg; relocated info. from pg. 4-16 and 4-17.	
	4-16b	New pg; relocated info. and para. 4.13 from pg. 4-17; added Note to para. 4.13.	
	4-17	Moved info. to pgs. 4-16a and 4-16b; relocated info. from pg. 4-18.	
	4-18	Moved info. to pg. 4-17; relocated info. from pg. 4-19.	
	4-19	Moved info. to pg. 4-18.	
	4-26	Revised para. 4.31; added Note; moved para. 4.33 to pg. 4-27.	
	4-27	Relocated para. 4.33 from pg. 4-26.	
	4-32	Added Note; moved info. to pg. 4-33.	
	4-33	Relocated info. from pg. 4-32; moved info. to pg. 4-34.	

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature and Date
Rev. 2 (PR810817) (cont)	4-34	Relocated info. from pg. 4-33; moved para. 4.49 to pg. 4-35.	
	4-35	Relocated para. 4.49 from pg. 4-34; moved para. 4.55 to pg. 4-36.	
	4-36	Relocated para. 4.55 from pg. 4-35; moved info. to pg. 4-37.	
	4-37	Relocated info. from pg. 4-36; moved para. 4.59 to pg. 4-38.	
	4-38	New pg; relocated para. from pg. 4-37.	
	6-i	Changed pg. nos.	
	6-11	Revised fig. 6-9.	
	6-12	Revised fig. 6-11.	
	6-32	Relocated items 147 thru 151 from pg. 6-33.	
	6-33	Moved items 147 thru 151 to pg. 6-32; added new item 154; relocated items 155 thru 159 from pg. 6-34.	
	6-34	Moved items 155 thru 159 to pg. 6-33; relocated item 173 from pg. 6-35.	
	6-35	Moved item 173 to pg. 6-34; removed previous item 177; added new items 177 and 178.	
	6-40	Revised item 223.	
	6-46	Added new items 264 and 265; renumbered item 266; moved items 271 and 273 to pg. 6-47.	

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature and Date
Rev. 2 (PR810817) (cont)	6-47	Relocated items 271 and 273 from pg. 6-46; added new item 272; moved items 281 and 283 to pg. 6-48.	
	6-48	Relocated items 281 and 283 from pg. 6-47; moved item 287 to pg. 6-49.	
	6-49	Relocated item 287 from pg. 6-48; moved item 291 to pg. 6-50.	
	6-50	Relocated item 291 from pg. 6-49.	
	6-62	Added new item 441.	
	7-14	Revised para. 7.15.	
	7-15	Revised fig. 7-11.	
	7-20	Added info.	
	7-21	Revised fig. 7-15.	
	9-46	Revised Supplement, Section 1.	
	9-49	Added Caution Note; moved info. to pg. 9-50.	
	9-50	Relocated info. from pg. 9-49.	
	9-51	Revised Supplement, Section 3.	
	9-53	Revised Supplement, Section 3.	Ward Evans
	9-105	Revised Supplement, Section 4.	Ward Evans Aug. 17, 1981
Rev. 3 (PR820225)	1-4	Corrected para. 1.9.	
	3-i	Expanded checklist; moved info. to pg. 3-ii.	
	3-ii	Relocated info. from pg. 3-i.	
	3-4	Revised para. 3.3.	
	3-15	Revised para. 3.7.	

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature and Date
Rev. 3 (PR820225) (cont)	3-23	Amended para. 3.29.	
	4-i	Expanded checklist; moved info. to pg. 4-ii.	
	4-ii	Relocated info. from pg. 4-i.	
	4-18	Revised para. 4.17.	
	4-30	Corrected error.	
	4-37	Removed Note.	
	5-3	Corrected error.	
	5-14	Revised fig. 5-7 heading info.	
	5-20	Corrected error to fig. 5-19 info.	
	5-22	Revised fig. 5-23 heading.	
	5-23	Revised fig. 5-25.	
	5-26	Revised fig. 5-31 pg. base info.	
	5-28	Amended fig. 5-35 notation.	
	5-29	Added grid alignment number to fig. 5-37.	
	5-30	Amended lettered info. to fig. 5-39.	
	5-31	Corrected error to fig. 5-41 example.	
	6-1	Revised para. 6.1.	
	6-6	Revised fig. 6-5 info.	
	6-9	Corrected para. 6.7 (b).	
	6-10	Revised para. 6.7.	
	6-11	Corrected fig. 6-9.	
	6-12	Corrected fig. 6-11.	
	6-19	Revised para. 6.13.	
	6-21	Revised item 11 data.	
	6-31	Revised item 135.	
	6-35	Revised item 177 data.	
	6-37	Revised item 193 data.	
	6-40	Revised item 223 b. data.	
	6-41	Revised item 227 a. data.	
	6-44	Revised item 255 data.	
	6-46	Revised and moved item 269 to pg. 6-47.	

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature and Date
Rev. 3 (PR820225) (cont)	6-47	Relocated item 269 from pg. 6-46; revised item 272 data; moved item 277 and 279 to pg. 6-48.	
	6-48	Relocated item 277 and 279 from pg. 6-47; moved item 285 to pg. 6-49.	
	6-49	Relocated item 285 from pg. 6-48; moved item 289 to pg. 6-50.	
	6-50	Relocated item 289 from pg. 6-49; revised item 293 data; moved item 295 and 297 to pg. 6-51.	
	6-51	Relocated items 295 and 297 from pg. 6-50; revised item 301 data.	
	6-52	Added new item 302.	
	6-54	Revised item 315; revised item 319 data.	
	6-56	Revised item 385 (f) data.	
	6-68	Moved info. to new pg. 6-69.	
	6-69	New pg.; relocated info. from pg. 6-68; added caution note.	
	7-3, 7-4	Revised para. 7.5.	
	7-12	Revised para. 7.11.	
	7-18	Revised voltage info. to para. 7.17.	
	7-19	Revised fig. 7-13.	
	7-20	Revised para. 7.17.	
	7-26	Revised para. 7.23.	
	7-29	Corrected info. listings 29, 46, 47.	
	7-34	Revised para. 7.27 info.	
	7-37	Amended para. 7.37.	
	8-14	Revised para. 8.23.	

PILOT'S OPERATING HANDBOOK LOG OF REVISIONS (cont)

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature and Date
Rev. 3 (PR820225) (cont)	8-17	Revised para. 8.31 (b).	
	8-19	Corrected error.	
	9-16	Corrected error.	
	9-20	Added info. to listing.	
	9-22	Revised caution note; corrected pg. no. error.	
	9-26	Corrected error.	
	9-27	Revised section 4 (g).	
	9-34	Added info. to listing.	
	9-35	Revised section 2 (f).	
	9-36	Revised caution note; corrected pg. no. error.	
	9-37	Revised section 3 (d) (2).	
	9-39	Corrected error.	
	9-41	Revised section 4 (4).	
	9-76	Corrected pg. no. error.	
	9-110	Revised note.	
	9-115	Revised note.	
	9-120	Corrected error.	
	9-123	Added heading to section 5.	Ward Evans
	9-125 thru 9-130	New pgs.; added supplement 19.	Ward Evans Feb. 25, 1982
Rev. 4 (PR820409)	3-i, 3-ii	Changed pg. nos.	
	3-5	Revised and added to procedure; moved info. to pg. 3-6.	
	3-6	Relocated info. from pg. 3-5; moved info. to pg. 3-7.	
	3-7	Relocated info. from pg. 3-6; moved info. to pg. 3-8.	
	3-8	Relocated info. from pg. 3-7; moved info. to pg. 3-9.	

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature and Date
Rev. 4 (PR820409) (cont)	3-9	Relocated info. from pg. 3-8; moved info. to pg. 3-10.	
	3-10	Relocated info. from pg. 3-9; moved info. to pg. 3-11.	
	3-11	Relocated info. from pg. 3-10.	
	3-16	Revised and added to para. 3.7.	
	3-17	Added to para. 3.7; moved info. to pg. 3-18.	
	3-18	Relocated info. from pg. 3-17; moved info. to pg. 3-19.	
	3-19	Relocated info. from pg. 3-18; moved info. to pg. 3-20.	
	3-20	Relocated info. from pg. 3-19; moved info. to pg. 3-21.	
	3-21	Relocated info. from pg. 3-20.	
	5-17	Revised fig. 5-13.	
	6-20	Revised items 1 and 3.	
	6-29	Added item 129.	
	7-5	Revised para. 7.7.	
	7-6	Cont. rev. para. 7.7; moved para. 7.9 to pg. 7-6b.	
	7-6a	New page.	
	7-6b	New page; relocated para. 7.9 from pg. 7-6.	Ward Evans
	8-10	Revised para. 8.17.	Ward Evans April 9, 1982
Rev. 5 (PR820809)	Title	Revised Title Page.	
	iii	Revised para.	
	1-1	Revised para. 1.1.	
	1-5	Revised para. 1.15.	
	3-ii	Revised Table of Contents.	
	3-9	Revised procedure.	
	3-20, 3-21	Revised para. 3.23.	

PILOT'S OPERATING HANDBOOK LOG OF REVISIONS (cont)

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature and Date
Rev. 5 (PR820809) (cont)	3-22	Moved info. to pg. 3-23 and 3-24, cont. revised para. 3.23.	
	3-23	Moved info. to pg. 3-24. cont. revised para. 3.23, re-	
	1-5	located info. from pg. 3-22.	
	3-24	New page; relocated info. from pg. 3-22 and 3-23.	
	3-25	New page; relocated info. from pg. 3-23.	
	4-16a	Revised para. 4.11.	
	5-3	Revised para. 5.5 (a).	
	6-i	Revised Table of Contents.	
	6-1	Revised para. 6.1.	
	6-2	Revised para. 6.3.	
	6-5	Revised para. 6.5.	
	6-7	Revised fig. 6-7.	
	6-11	Revised fig. 6-9.	
	6-15	Revised para. 6.11.	
	7-18	Revised para. 7.17.	
	7-19	Revised fig. 7-13.	
	7-19a	New page, added fig. 7-14.	
	7-19b	New page, cont. revised para. 7.17.	
	7-20	Cont. revised para. 7.17.	
	7-26, 7-27	Revised para. 7.23.	
	7-28, 7-29	Revised fig. 7-21.	
	7-29a, 7-29b	New pages, added fig. 7-22.	
	7-34	Revised para. 7.27.	Ward Evans
	7-35	Revised para. 7.29.	Ward Evans
	7-36	Revised para. 7.31 and 7.33.	August 9, 1982

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature and Date
Rev. 6 (PR830923)	1-4	Added items (c) (3) and (c) (4) to para. 1.5.	
	1-8	Revised barometric pressure (mb).	
	1-10	Deleted MEA.	
	2-4	Added items (i) c. and (i) d. to para. 2.7.	
	2-12	Relocated fuel placard to pg. 2-13.	
	2-13	Added pg. (added new and relocated fuel placards).	
	5-9	Revised Figures 5-27, 5-29 and 5-31.	
	5-24	Revised Figure 5-27.	
	5-25	Revised Figure 5-29.	
	5-26	Revised Figure 5-31.	
	5-27	Revised Figure 5-33.	
	5-28	Revised Figure 5-35.	
	7-16	Revised para. 7.15 info.	
	7-20	Added Caution.	
	7-33	Revised para. 7.25 info.	
	8-i	Revised pg. no.	
	8-2	Revised para. 8.3 info.	
	8-3	Revised para. 8.5 info.	
	8-4	Deleted para. 8.5 info.	
	8-19	Revised item 8.31 (g); relocated para. 8.33.	
	8-20	Added pg. (added para. 8.33).	
	9-i	Relocated Supplement No. 19 to pg. 9-ii.	
	9-ii	Added pg. (added Supplements 19 and 20).	
	9-10	Revised Section 1 info.; relocated info. to pg. 9-11.	
	9-11	Added and relocated info.	
	9-12	Added info.	
	9-28	Revised item (h) (1).	
	9-42	Revised item (h) (1).	

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature and Date
Rev. 6 (PR830923) (cont)	9-82	Deleted Note.	
	9-131 thru 9-134	Added Supplement No. 20. (Edo-Avionics Command Electric Trim System)	Ward Evans Ward Evans Sept. 23, 1983
Rev. 7 (PR840210)	4-5	Added Warning; moved info. to pg. 4-6.	
	4-6	Relocated info. from pg. 4-5; moved info. to pg. 4-7.	
	4-7	Relocated info. from pg. 4-6.	
	4-8	Revised procedure.	
	4-9	Revised procedure.	
	4-10	Revised procedure.	
	4-16b	Revised para. 4.13.	
	4-25	Revised para. 4.29.	
	4-26	Revised para. 4.31.	
	4-28	Revised para. 4.33.	
	7-i	Revised Table of Contents.	
	7-11	Relocated info. from pg. 7-12.	
	7-12	Moved info. to pg. 7-11; revised para. 7.11.	
	8-6	Revised para. 8.9; moved info. to pg. 8-7.	
	8-7	Relocated info. from pg. 8-6; moved info. to pg. 8-8.	
	8-8	Relocated info. from pg. 8-7.	
	9-i	Revised Table of Contents.	
	9-ii	Added Supplement 21.	
	9-9	Revised title.	
	9-10	Revised text.	
	9-135 thru 9-154	Added pages; added Supplement 21, Century 31 Autopilot Installation.	Ward Evans Ward Evans Feb. 10, 1984

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SECTION 1

GENERAL

SECTION 1

GENERAL

1.1 INTRODUCTION

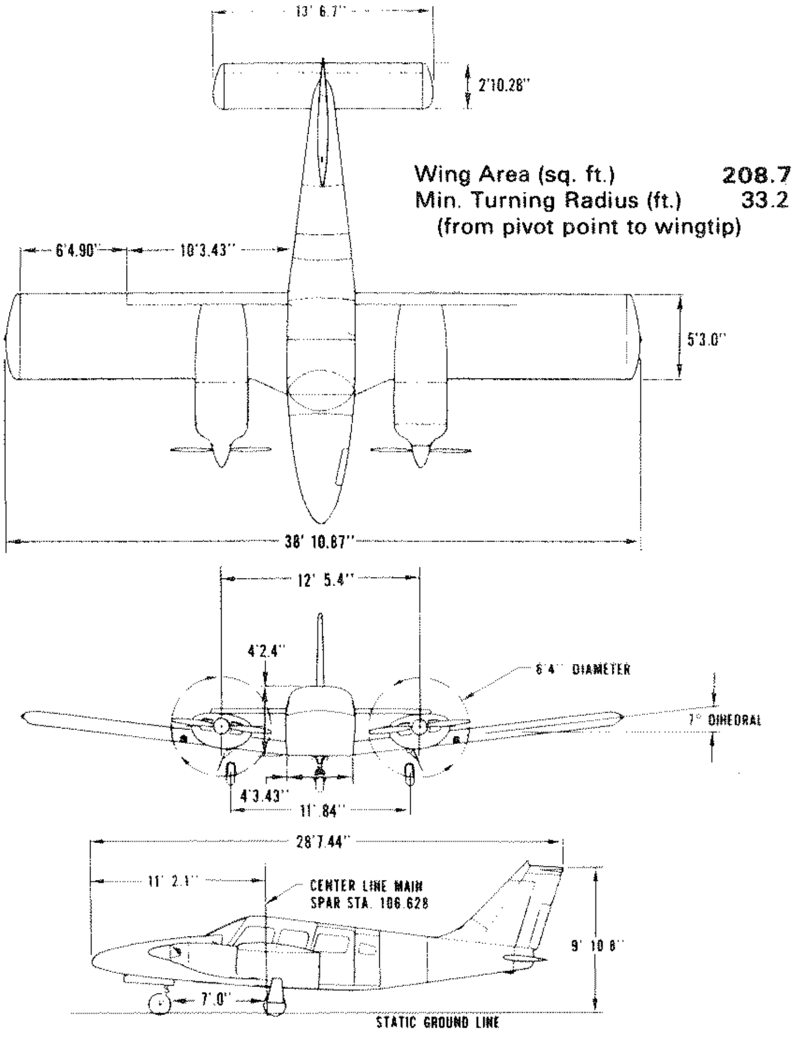
This Pilot's Operating Handbook is designed for maximum utilization as an operating guide for the pilot. It includes the material required to be furnished to the pilot by FAR 23. It also contains supplemental data supplied by the airplane manufacturer.

This handbook is not designed as a substitute for adequate and competent flight instruction, knowledge of current airworthiness directives and applicable federal air regulations or advisory circulars. It is not intended to be a guide for basic flight instruction or a training manual and should not be used for operational purposes unless kept in a current status.

Assurance that the airplane is in an airworthy condition is the responsibility of the owner. The pilot in command is responsible for determining that the airplane is safe for flight. The pilot is also responsible for remaining within the operating limitations as outlined by instrument markings, placards, and this handbook.

Although the arrangement of this handbook is intended to increase its in-flight capabilities, it should not be used solely as an occasional operating reference. The pilot should study the entire handbook to become familiar with the limitations, performance, procedures and operational handling characteristics of the airplane before flight.

The handbook has been divided into numbered (arabic) sections, each provided with a "finger-tip" tab divider for quick reference. The limitations and emergency procedures have been placed ahead of the normal procedures, performance and other sections to provide easier access to information that may be required in flight. The "Emergency Procedures" Section has been furnished with a red tab divider to present an instant reference to the section. Provisions for expansion of the handbook have been made by the deliberate omission of certain paragraph numbers, figure numbers, item numbers and pages noted as being intentionally left blank.



THREE VIEW
Figure 1-1

1.3 ENGINE

(a) Number of Engines		2
(b) Engine Manufacturer		Continental
(c) Engine Model Number		
(1) Left		TSIO-360KB
(2) Right		LTSIO-360KB
	T.O. Power 5 Min. Limit	Max. Cont. Power
(d) Rated Horsepower	220 BHP	200 BHP
(e) Rated Speed (rpm)	2800	2600
(f) Bore (inches)		4.438
(g) Stroke (inches)		3.875
(h) Displacement (cubic inches)		360
(i) Compression Ratio		7.5:1
(j) Engine Type		Six Cylinder, Direct Drive, Horizontally Opposed, Air Cooled

1.5 PROPELLER

STANDARD

(a) Number of Propellers	2
(b) Propeller Manufacturer	Hartzell
(c) Propeller Hub & Blade Models*	
(1) Left	BHC-C2YF-2CKUF/ FC8459-8R
(2) Right	BHC-C2YF-2CLKUF/ FJC8459-8R
(d) Number of Blades	2
(e) Propeller Diameter (in.)	
(1) Maximum	76
(2) Minimum	75
(f) Propeller Type	Constant Speed, Hydraulically Activated, Full Feathering

*The propellers have the same designation when deicing boots are installed.

OPTIONAL

(a) Number of Propellers	2
(b) Propeller Manufacturer	McCauley
(c) Propeller Hub & Blade Models*	
(1) Left	3AF32C508/ 82NFA-6
(2) Right	3AF32C509/ L82NFA-6
or	
(3) Left	32AF32C508-( ) ( )-82NFA-6
(4) Right	32AF32C509-( ) ( )-L82NFA-6
(d) Number of Blades	3
(e) Propeller Diameter (in.)	
(1) Maximum	76
(2) Minimum	75
(f) Propeller Type	Constant Speed, Hydraulically Activated, Full Feathering

1.7 FUEL

(a) Fuel Capacity (U.S. gal.) (total)	
(1) Without optional tanks	98
(2) With optional tanks	128
(b) Usable Fuel (U.S. gal.) (total)	
(1) Without optional tanks	93
(2) With optional tanks	123
(c) Fuel	
(1) Minimum Grade	100 Green or 100LL Blue Aviation Grade
(2) Alternate Fuels	Refer to latest revision of Continental Service Bulletin "Fuel and Oil Grades."

1.9 OIL

(a) Oil Capacity (U.S. qts.) (per engine)	8
(b) Oil Specification	Refer to latest revision of Continental Service Bulletin "Fuel and Oil Grades."

*The propellers have the same designation when deicing boots are installed.

(c) Oil Viscosity

	Aviation Grade	S.A.E. No.
(1) Below 40°F	1065	30
(2) Above 40°F	1100	50

When operating temperatures overlap indicated ranges, use the lighter grade of oil. Multi-viscosity oils meeting Teledyne Continental Motors' Specification MHS-24A are approved.

1.11 MAXIMUM WEIGHTS

(a) Max. Ramp Weight (lbs.)	4773
(b) Max. Takeoff Weight (lbs.)	4750
(c) Max. Landing Weight (lbs.)	4513
(d) Max. Zero Fuel Weight (lbs.) - Std.	4470
(e) Max. Weights in Baggage Compartment (lbs.)	
(1) Forward	100
(2) Aft	100

1.13 STANDARD AIRPLANE WEIGHTS

Refer to Figure 6-5 for the Standard Empty Weight and the Useful Load.

1.15 BAGGAGE SPACE

	FORWARD	AFT
(a) Maximum Baggage (lbs.)	100	100
(b) Baggage Space (cu. ft.)	15.3	17.3
(c) Baggage Door Size (in.)	24 x 21	

1.17 SPECIFIC LOADINGS

(a) Wing Loading (lbs. per sq. ft.)	22.8
(b) Power Loading (lbs. per hp)	10.8

1.19 SYMBOLS, ABBREVIATIONS AND TERMINOLOGY

The following definitions are of symbols, abbreviations and terminology used throughout the handbook and those which may be of added operational significance to the pilot.

(a) General Airspeed Terminology and Symbols

CAS	Calibrated Airspeed means the indicated speed of an aircraft, corrected for position and instrument error. Calibrated airspeed is equal to true airspeed in standard atmosphere at sea level.
KCAS	Calibrated Airspeed expressed in "Knots."
GS	Ground Speed is the speed of an airplane relative to the ground.
IAS	Indicated Airspeed is the speed of an aircraft as shown on the airspeed indicator when corrected for instrument error. IAS values published in this handbook assume zero instrument error.
KIAS	Indicated Airspeed expressed in "Knots."
M	Mach Number is the ratio of true airspeed to the speed of sound.
TAS	True Airspeed is the airspeed of an airplane relative to undisturbed air which is the CAS corrected for altitude, temperature and compressibility.
V_A	Maneuvering Speed is the maximum speed at which application of full available aerodynamic control will not overstress the airplane.
V_{FE}	Maximum Flap Extended Speed is the highest speed permissible with wing flaps in a prescribed extended position.

V_{LE}	Maximum Landing Gear Extended Speed is the maximum speed at which an aircraft can be safely flown with the landing gear extended.
V_{LO}	Maximum Landing Gear Operating Speed is the maximum speed at which the landing gear can be safely extended or retracted.
V_{MCA}	Air Minimum Control Speed is the minimum flight speed at which the airplane is directionally controllable as determined in accordance with Federal Aviation Regulations. Airplane certification conditions include one engine becoming inoperative and windmilling; not more than a 5° bank towards the operative engine; takeoff power on operative engine; landing gear up; flaps in takeoff position; and most rearward C.G.
V_{NE}/M_{NE}	Never Exceed Speed or Mach Number is the speed limit that may not be exceeded at any time.
V_{NO}	Maximum Structural Cruising Speed is the speed that should not be exceeded except in smooth air and then only with caution.
V_S	Stalling Speed or the minimum steady flight speed at which the airplane is controllable.
V_{SO}	Stalling Speed or the minimum steady flight speed at which the airplane is controllable in the landing configuration.
V_{SSE}	Intentional One Engine Inoperative Speed is a minimum speed selected by the manufacturer for intentionally rendering one engine inoperative in flight for pilot training.

V_X — Best Angle-of-Climb Speed is the airspeed which delivers the greatest gain of altitude in the shortest possible horizontal distance.

V_Y — Best Rate-of-Climb Speed is the airspeed which delivers the greatest gain in altitude in the shortest possible time.

(b) Meteorological Terminology

ISA — International Standard Atmosphere in which: The air is a dry perfect gas; The temperature at sea level is 15° Celsius (59° Fahrenheit); The pressure at sea level is 29.92 inches Hg (1013.2 mb); The temperature gradient from sea level to the altitude at which the temperature is -56.5°C (-69.7°F) is -0.00198°C (-0.003566°F) per foot and zero above that altitude.

OAT — Outside Air Temperature is the free air static temperature obtained either from inflight temperature indications or ground meteorological sources, adjusted for instrument error and compressibility effects.

Indicated Pressure Altitude — The number actually read from an altimeter when the barometric subscale has been set to 29.92 inches of mercury (1013.2 millibars).

Pressure Altitude — Altitude measured from standard sea-level pressure (29.92 in. Hg) by a pressure or barometric altimeter. It is the indicated pressure altitude corrected for position and instrument error. In this handbook, altimeter instrument errors are assumed to be zero.

Station Pressure — Actual atmospheric pressure at field elevation.

Wind	The wind velocities recorded as variables on the charts of this handbook are to be understood as the headwind or tailwind components of the reported winds.

(c) Power Terminology

Takeoff Power	Maximum power permissible for takeoff.
Maximum Continuous Power	Maximum power permissible continuously during flight.
Maximum Climb Power	Maximum power permissible during climb.
Maximum Cruise Power	Maximum power permissible during cruise.

(d) Engine Instruments

EGT Gauge	Exhaust Gas Temperature Gauge

(e) Airplane Performance and Flight Planning Terminology

Climb Gradient	The demonstrated ratio of the change in height during a portion of a climb, to the horizontal distance traversed in the same time interval.
Demonstrated Crosswind Velocity (DEMO. X-WIND)	The demonstrated crosswind velocity is the velocity of the crosswind component for which adequate control of the airplane during takeoff and landing was actually demonstrated during certification tests.
Accelerate-Stop Distance	The distance required to accelerate an airplane to a specified speed and, assuming failure of an engine at the instant that speed is attained, to bring the airplane to a stop.

Route Segment	A part of a route. Each end of that part is identified by: (1) a geographical location; or (2) a point at which a definite radio fix can be established.

(f) Weight and Balance Terminology

Reference Datum	An imaginary vertical plane from which all horizontal distances are measured for balance purposes.
Station	A location along the airplane fuselage usually given in terms of distance in inches from the reference datum.
Arm	The horizontal distance from the reference datum to the center of gravity (C.G.) of an item.
Moment	The product of the weight of an item multiplied by its arm. (Moment divided by a constant is used to simplify balance calculations by reducing the number of digits.)
Center of Gravity (C.G.)	The point at which an airplane would balance if suspended. Its distance from the reference datum is found by dividing the total moment by the total weight of the airplane.
C.G. Arm	The arm obtained by adding the airplane's individual moments and dividing the sum by the total weight.
C.G. Limits	The extreme center of gravity locations within which the airplane must be operated at a given weight.
Usable Fuel	Fuel available for flight planning.

Unusable Fuel	Fuel remaining after a runout test has been completed in accordance with governmental regulations.
Standard Empty Weight	Weight of a standard airplane including unusable fuel, full operating fluids and full oil.
Basic Empty Weight	Standard empty weight plus optional equipment.
Payload	Weight of occupants, cargo and baggage.
Useful Load	Difference between takeoff weight, or ramp weight if applicable, and basic empty weight.
Maximum Ramp Weight	Maximum weight approved for ground maneuver. (It includes weight of start, taxi and run up fuel.)
Maximum Takeoff Weight	Maximum weight approved for the start of the takeoff run.
Maximum Landing Weight	Maximum weight approved for the landing touchdown.
Maximum Zero Fuel Weight	Maximum weight exclusive of usable fuel.

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SECTION 2

LIMITATIONS

SECTION 2

LIMITATIONS

2.1 GENERAL

This section provides the "FAA Approved" operating limitations, instrument markings, color coding and basic placards necessary for the operation of the airplane and its systems.

This airplane must be operated as a normal category airplane in compliance with the operating limitations stated in the form of placards and markings and those given in this section and handbook.

Limitations associated with those optional systems and equipment which require handbook supplements can be found in Section 9 (Supplements).

2.3 AIRSPEED LIMITATIONS

SPEED	KIAS	KCAS
Design Maneuvering Speed (V_A) - Do not make full or abrupt control movements above this speed.		
4750 lbs.	140	140
3205 lbs.	114	115

CAUTION

Maneuvering speed decreases at lighter weight as the effects of aerodynamic forces become more pronounced. Linear interpolation may be used for intermediate gross weights. Maneuvering speed should not be exceeded while operating in rough air.

SPEED	KIAS	KCAS
Never Exceed Speed (V_{NE}) - Do not exceed this speed in any operation.	205	203
Maximum Structural Cruising Speed (V_{NO}) - Do not exceed this speed except in smooth air and then only with caution.	166	165
Maximum Flaps Extended Speed (V_{FE}) - Do not exceed this speed with the flaps extended.	115	113
Maximum Gear Extended Speed (V_{LE}) - Do not exceed this speed with landing gear extended.	130	130
Maximum Landing Gear Extending Speed (V_{LO}) - Do not extend landing gear above this speed.	130	130
Maximum Landing Gear Retracting Speed (V_{LO}) - Do not retract landing gear above this speed.	108	109
Air Minimum Control Speed (V_{MCA}) - Lowest airspeed at which airplane is controllable with one engine operating at takeoff power and no flaps.	66	65
One Engine Inoperative Best Rate of Climb Speed. (V_{YSE})	92	91

2.5 AIRSPEED INDICATOR MARKINGS

MARKING	KIAS
Red Radial Line (Never Exceed)	205
Red Radial Line (One Engine Inoperative Air Minimum Control Speed)	66

MARKING	KIAS
Blue Radial Line (One Engine Inoperative Best Rate of Climb (Speed)	92
Yellow Arc (Caution Range - Smooth Air Only)	166 to 205
Green Arc (Normal Operating Range)	67 to 166
White Arc (Flap Down)	64 to 115

2.7 POWER PLANT LIMITATIONS

(a) Number of Engines		2
(b) Engine Manufacturer		Continental
(c) Engine Model Number		
(1) Left		TSIO-360KB
(2) Right		LTSIO-360KB
(d) Engine Operating Limits		
	T.O. Power 5 Min. Limit	Max. Cont. Power
(1) Rated Horsepower (BHP)	220	200
(2) Max. Rotational Speed (RPM)	2800	2600
(3) Max. Manifold Pressure (Inches of Mercury)		40
(4) Max. Cylinder Head Temperature		460° F
(5) Max. Oil Temperature		240° F
(e) Oil Pressure		
Minimum (red line)		10 PSI
Maximum (red line)		100 PSI
(f) Fuel Flow (Pressure)		
Normal Operating Range (green arc)		3.5 PSI to 18.1 PSI
Maximum at Sea Level (red line)		21 PSI
(g) Fuel Grade (min. grade)		100 or 100LL Aviation Grade
(h) Number of Propellers		2

(i) Propeller Manufacturer
Hartzell (Two Blade) (Standard)
Propeller Hub and Blade Models

a. Left	BHC-C2YF-2CKUF/ FC8459-8R
b. Right	BHC-C2YF-2CLKUF/ FJC8459-8R
or	
c. Left	32AF32C508-( )/ ( )-82NFA-6
d. Right	32AF32C509-( )/ ( )-L82NFA-6

NOTES

Avoid continuous operation between 2000 and 2200 RPM above 32 IN. HG. manifold pressure.

Avoid continuous ground operation between 1700 and 2100 RPM in cross and tail winds over 10 knots.

McCauley (Three Blade) (Optional)
Propeller Hub and Blade Models

a. Left	3AF32C508/ 82NFA-6
b. Right	3AF32C509/ L82NFA-6

(j) Propeller Diameter (inches)

Maximum	76
Minimum	75

2.9 POWER PLANT INSTRUMENT MARKINGS

(a) Tachometer	
Green Arc (Normal Operating Range)	500 RPM to 2600 RPM
Yellow Arc (Takeoff - 5 Min.)	2600 RPM to 2800 RPM
Red Line (Maximum)	2800 RPM
(b) Fuel Flow (Pressure)	
Green Arc (Normal Operating Range)	3.5 PSI to 18.1 PSI
Yellow Arc (Takeoff - 5 Min.)	18.1 PSI to 21.0 PSI
Red Line (Max. at Sea Level)	21.0 PSI
(c) Cylinder Head Temperature	
Green Arc (Normal Range)	240° F to 460° F
Red Line (Maximum)	460° F
(d) Oil Temperature	
Green Arc (Normal Operating Range)	100° F to 240° F
Red Line (Maximum)	240° F
(e) Oil Pressure	
Green Arc (Normal Operating Range)	30 PSI to 80 PSI
Yellow Arc (Caution - Ground Operation Only)	10 PSI to 30 PSI and 80 PSI to 100 PSI
Red Line (Minimum)	10 PSI
Red Line (Maximum)	100 PSI
(f) Manifold Pressure	
Green Arc (Normal Operating Range)	10 IN. to 40 IN. HG.
Red Line (Maximum)	40 IN. HG.
(g) Exhaust Gas Temperature	
Red Line	1650° F
Green Arc	1200° F to 1525° F
Yellow Arc (65% to 75% Leaning Limit)	1525° F to 1650° F

2.11 WEIGHT LIMITS

(a)	Max. Ramp Weight	4773 LBS.
(b)	Max. Takeoff Weight	4750 LBS.
(c)	Max. Landing Weight	4513 LBS.
(d)	Max. Weights in Baggage Compartments	
	Forward	100 LBS.
	Aft	100 LBS.
(e)	Max. Zero Fuel Weight - Standard (Refer to Section 6, Weight and Balance)	4470 LBS.

2.13 CENTER OF GRAVITY LIMITS

Weight Pounds	Forward Limit Inches Aft of Datum	Rearward Limit Inches Aft of Datum
3400	82.0	94.6
4250	86.7	94.6
4750	90.6	94.6

NOTES

Straight line variation between points given.

The datum used is 78.4 inches ahead of the wing leading edge at the inboard edge of the fuel tank.

It is the responsibility of the airplane owner and the pilot to ensure that the airplane is properly loaded. See Section 6 (Weight and Balance) for proper loading instructions.

2.15 MANEUVER LIMITS

All intentional acrobatic maneuvers (including spins) are prohibited. Avoid abrupt maneuvers.

2.17 FLIGHT MANEUVERING LOAD FACTORS

(a) Positive Load Factor (Maximum)	
(1) Flaps Up	3.8 G
(2) Flaps Down	2.0 G
(b) Negative Load Factor (Maximum)	No inverted maneuvers approved.

2.19 TYPES OF OPERATION

The airplane is approved for the following operations when equipped in accordance with FAR 91 or FAR 135.

(a) Day V.F.R.
(b) Night V. F.R.
(c) Day I.F.R.
(d) Night I.F.R.
(e) Icing conditions when equipped per Ice Protection System Installation Supplement (refer to Section 9).

2.21 FUEL LIMITATIONS

(a) Standard Fuel Tanks

(1) Total Capacity	98 U.S. GALS.
(2) Unusable Fuel	5 U.S. GALS.

The unusable fuel for this airplane has been determined as 2.5 U.S. gallons in each wing in critical flight attitudes.

(3) Usable Fuel	93 U.S. GALS.

(b) Optional Fuel Tanks

(1) Total Capacity	128 U.S. GALS.
(2) Unusable Fuel	5 U.S. GALS.
(3) Usable Fuel	123 U.S. GALS.

2.23 NOISE LEVEL

The corrected noise level of this aircraft is 71.4d B(A) with the two blade propeller and 74.2d B(A) with the three blade propeller.

No determination has been made by the Federal Aviation Administration that the noise levels of this airplane are or should be acceptable or unacceptable for operation at, into, or out of, any airport.

The above statement notwithstanding, the noise level stated above has been verified by and approved by the Federal Aviation Administration in noise level test flights conducted in accordance with FAR 36, Noise Standards - Aircraft Type and Airworthiness Certification. This aircraft model is in compliance with all FAR 36 noise standards applicable to this type.

2.25 HEATER LIMITATIONS

Operation of the combustion heater above 25,000 feet is not approved.

2.27 OPERATING ALTITUDE LIMITATIONS

Flight above 25,000 feet is not approved. Flight up to and including 25,000 feet is approved if equipped with oxygen in accordance with FAR 23.1441 and avionics in accordance with FAR 91 or FAR 135.

2.29 GYRO SUCTION LIMITS

The operating limits for the suction system are 4.8 to 5.1 inches of mercury for all operations as indicated by the gyro suction gauge.

2.31 OPERATION WITH AFT DOORS REMOVED

The maximum speed with the aft doors removed is 129 KIAS and the minimum single engine control speed is 67 KIAS. Door off operation is approved for VFR non-icing conditions only.

2.33 PLACARDS

In full view of the pilot:

THIS AIRPLANE MUST BE OPERATED AS A NORMAL CATEGORY AIRPLANE IN COMPLIANCE WITH THE OPERATING LIMITATIONS STATED IN THE FORM OF PLACARDS, MARKINGS, AND MANUALS. NO ACROBATIC MANEUVERS (INCLUDING SPINS) APPROVED.

THIS AIRCRAFT APPROVED FOR V.F.R., I.F.R., DAY, NIGHT AND ICING FLIGHT WHEN EQUIPPED IN ACCORDANCE WITH FAR 91 OR FAR 135.

In full view of the pilot:

MAXIMUM TAKEOFF WEIGHT 4750 POUNDS
MAXIMUM LANDING WEIGHT 4513 POUNDS
ALL WEIGHT IN EXCESS OF 4470 POUNDS MUST CONSIST OF FUEL. (EXCEPT IN CASES SPECIFIED BY SECTION 6 OF P.O.H.).

MINIMUM SINGLE ENGINE CONTROL SPEED 66 KIAS

On instrument panel in full view of the pilot:

V_A 140 AT 4750 LBS.
(SEE A.F.M.)
V_{LO} 130 DN, 108 UP
V_{LE} 130 MAX.
DEMO X-WIND 17 KTS

Near emergency gear release:

EMERGENCY GEAR EXTENSION
PULL TO RELEASE. SEE A.F.M.
BEFORE RE-ENGAGEMENT

Near gear selector switch:

GEAR UP	108 KIAS MAX.
DOWN	130 KIAS MAX.

Adjacent to upper door latch (front and rear doors):

ENGAGE LATCH BEFORE FLIGHT

In full view of pilot:

WARNING - TURN OFF STROBE LIGHTS WHEN TAXIING IN VICINITY OF OTHER AIRCRAFT OR DURING FLIGHT THROUGH CLOUD, FOG OR HAZE.

On the inside of forward baggage compartment door:

MAXIMUM BAGGAGE THIS COMPARTMENT 100 LBS. SEE THE LIMITATIONS SECTION OF THE AIRPLANE FLIGHT MANUAL.

On aft baggage closeout:

MAXIMUM BAGGAGE THIS COMPARTMENT 100 LBS. NO HEAVY OBJECTS ON HAT SHELF.

In full view of pilot:

SINGLE ENGINE STALLS NOT RECOMMENDED. CAN CAUSE 400 FT. LOSS OF ALTITUDE AND 15° PITCH ANGLE.

On sun visor:

TAKEOFF CHECK LIST	LANDING CHECK LIST
Fuel Selectors On	Seat Backs Erect
Aux. Fuel Pumps Off	Fasten Belts/Harness
Alernators On	Fuel Selectors On
Engine Gages Checked	Cowl Flaps Set
Mixtures Set	Mixtures Rich
Propellers Set	Aux. Fuel Pumps Off
Alt. Air Off	Propellers Set
Cowl Flaps Open	Gear Down
Seat Backs Erect	Flap Set - (White Arc)
Flaps Set	Air Conditioner Off
Trim Set (Stab. & Rudder)	
Fasten Belts/Harness	
Controls Free - Full Travel	
Doors Latched/Air Cond. Off	

The "Air Conditioner Off" item in the above takeoff and landing check list is mandatory for air conditioned aircraft only.

On storm window:

DO NOT OPEN ABOVE 129 KIAS

In full view of the pilot for flight with the aft fuselage doors removed:

FOR FLIGHT WITH AFT DOORS REMOVED, CONSULT THE LIMITATIONS AND PROCEDURES SECTIONS OF THE AIRPLANE FLIGHT MANUAL.

On the inside of both oil filter access doors:

OIL COOLER WINTERIZATION PLATE TO BE REMOVED WHEN AMBIENT TEMPERATURE EXCEEDS 50° F.

On the executive writing table:

CAUTION - THIS TABLE MUST BE STOWED DURING TAKEOFF AND LANDING.

On the instrument panel in full view of the pilot (2-blade propellers only):

AVOID CONTINUOUS GROUND OPERATION 1700 - 2100 RPM IN CROSS TAIL WIND OVER 10 KT.

AVOID CONTINUOUS OPERATIONS 2000 - 2200 RPM ABOVE 32" MANIFOLD PRESSURE.

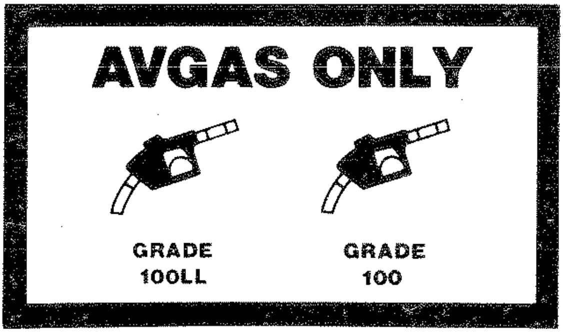
Near the magnetic compass:

CAUTION - COMPASS CALIBRATION MAY BE IN ERROR WITH ELECTRICAL EQUIPMENT OTHER THAN AVIONICS ON.

Adjacent to fuel tank filler caps:

FUEL 100 OR 100LL AVIATION GRADE

Adjacent to fuel tank filler caps (serial numbers 34-8333042 and up):



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EMERGENCY PROCEDURES

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SECTION 3

EMERGENCY PROCEDURES

3.1 GENERAL

The recommended procedures for coping with various types of emergencies and critical situations are provided by this section. Required (FAA regulations). emergency procedures and those necessary for the operation of the airplane as determined by the operating and design features of the airplane are presented.

Emergency procedures associated with those optional systems and equipment which require handbook supplements are provided by Section 9 (Supplements).

The first portion of this section consists of an abbreviated emergency checklist which supplies an action sequence for critical situations with little emphasis on the operation of systems.

The remainder of the section is devoted to amplified emergency procedures containing additional information to provide the pilot with a more complete understanding of the procedures.

Pilots should familiarize themselves with the procedures given in this section and be prepared to take appropriate action should an emergency arise.

Most basic emergency procedures, such as power off landings, are a normal part of pilot training. Although these emergencies are discussed here, this information is not intended to replace such training, but only to provide a source of reference and review, and to provide information on procedures which are not the same for all aircraft. It is suggested that the pilot review standard emergency procedures periodically to remain proficient in them.

3.3 EMERGENCY PROCEDURES CHECKLIST

AIRSPEEDS FOR SAFE OPERATIONS

One engine inoperative air minimum control .... 66 KIAS
One engine inoperative best rate of climb .... 92 KIAS
One engine inoperative best angle of climb .... 78 KIAS
Maneuvering .... 140 KIAS
Never exceed .... 205 KIAS

ENGINE INOPERATIVE PROCEDURES

NOTE

The power on the operating engine should be reduced when safe to do so.

DETECTING DEAD ENGINE

Loss of thrust.
Nose of aircraft will yaw in direction of dead engine (with coordinated controls).

ENGINE SECURING PROCEDURE (FEATHERING PROCEDURE)

Minimum control speed .... 66 KIAS
One engine inoperative best rate of climb .... 92 KIAS
Maintain direction and airspeed above 85 KIAS.
Mixture controls .... forward
Propeller controls .... forward
Throttle controls .... (40 in. Hg. Max.) forward
Flaps .... retract
Gear .... retract
Identify inoperative engine.
Throttle of inop. engine .... retard to verify

To attempt to restore power prior to feathering:

Mixtures . . . . as required
Fuel selector . . . . ON
Magnetos . . . . left or right only
Aux. fuel pump . . . . unlatch, ON HI, if power is not immediately restored - OFF
Alternate air . . . . ON

If power cannot be restored continue with feathering procedure.

Prop control of inop. engine . . . . feather before RPM drops below 800
Mixture of inop. engine . . . . idle cut-off
Trim . . . . as required (3° to 5° of bank toward operative engine - ball 1/2 to 1 out)
Aux. fuel pump of inop. engine . . . . OFF
Magnetos of inop. engine . . . . OFF
Cowl flaps . . . . close on inop. engine, as required on operative engine
Alternator of inop. engine . . . . OFF
Electrical load . . . . reduce
Fuel selector . . . . OFF inop. engine, consider crossfeed
Aux. fuel pump operative engine . . . . OFF
Power of operative engine . . . . as required

ENGINE FAILURE DURING TAKEOFF (Below 85 KIAS)

If engine failure occurs during takeoff and 85 KIAS has not been attained:

Throttles . . . . CLOSE both immediately
Stop straight ahead.

If inadequate runway remains to stop:

Throttles . . . . CLOSED
Brakes . . . . apply max. braking
Battery switch . . . . OFF
Fuel selectors . . . . OFF
Continue straight ahead, turning to avoid obstacles.

ENGINE FAILURE DURING TAKEOFF (85 KIAS or above)

If engine failure occurs during takeoff ground roll or after lift-off with gear still down and 85 KIAS has been attained:
If adequate runway remains, CLOSE both throttles immediately, land if airborne and stop straight ahead.
If runway remaining is inadequate for stopping, decide whether to abort or continue. If decision is made to continue, maintain heading. After establishing a climb, retract landing gear, accelerate to 92 KIAS, and feather inoperative engine prop (see Engine Securing Procedure).

WARNING

In certain combinations of aircraft weight, configuration, ambient conditions and speeds, negative climb performance may result. Refer to One Engine Inoperative Climb Performance chart, Figure 5-21.

ENGINE FAILURE DURING FLIGHT (Below 66 KIAS)

Rudder .... apply toward operative engine
Throttles (both) .... retard to stop turn
Pitch attitude .... lower nose to accelerate above 66 KIAS*
Operative engine .... increase power as airspeed increases above 66 KIAS*

If altitude permits, a restart may be attempted. If restart fails or if altitude does not permit restart, see Engine Securing Procedure.

ONE ENGINE INOPERATIVE LANDING

Inop. engine prop .... feather
When certain of making field:
Landing gear .... extend
Wing flaps (as required) .... lower
Maintain additional altitude and speed during approach.
Final approach speed .... 90 KIAS

*67 KIAS with aft doors removed.

ONE ENGINE INOPERATIVE GO-AROUND
(SHOULD BE AVOIDED IF AT ALL POSSIBLE)

Mixture .... forward
Propeller .... forward
Throttle .... (40 in. Hg. Max.) open slowly
Flaps .... retract
Landing gear .... retract
Airspeed .... 92 KIAS
Trim .... set
Cowl flap operating engine .... as required

AIR START (UNFEATHERING PROCEDURE)

Fuel selector inop. engine .... ON
Aux. fuel pump inop. engine .... LO boost
Throttle .... open 1/4 inch
Mixture .... RICH
Magneto switches .... ON
Prop control .... full forward
Starter .... engage until propeller windmills
Throttle .... reduce power until engine is warm
Aux. fuel pump .... OFF

If engine does not start, prime as required.
Alternator (after restart) .... ON

AIR START (UNFEATHERING PROCEDURE)

On Airplanes Equipped With Unfeathering Accumulators

Fuel selector inop. engine .... ON
Aux. fuel pump inop. engine .... LO boost
Throttle .... open 1/4 inch
Mixture .... RICH
Magneto switches .... ON
Prop control & latch .... push full forward
Throttle .... reduce power until engine is warm
Aux. fuel pump .... OFF

If engine does not start, prime as required, and engage starter.
Alternator (after restart) .... ON

NOTE

The starter may be used in conjunction with the unfeathering accumulators if required.

FIRE

ENGINE FIRE ON GROUND:

If engine has not started:
Mixture .... idle cut-off
Throttle .... open
Starter.................................... crank engine

If engine has already started and is running, continue operating to try pulling the fire into the engine.
If fire continues, extinguish with best available means.
If external fire extinguishing is to be applied:
Fuel selector valves.................................... OFF
Mixture .... idle cut-off

ENGINE FIRE IN FLIGHT

Affected engine:
Fuel selector .... OFF
Throttle .... close
Propeller....................................feather
Mixture .... idle cut-off
Heater.................................... OFF
Defroster .... OFF
If terrain permits land immediately.

FUEL MANAGEMENT DURING ONE ENGINE INOPERATIVE OPERATION

CRUISING

When using fuel from tank on the same side as the operating engine:
Fuel selector operating engine .... ON

Fuel selector inop. engine .... OFF
Aux. fuel pumps .... OFF

When using fuel from tank on the side opposite the operating engine:
Fuel selector operating engine .... CROSSFEED
Fuel selector inop. engine .... OFF
Aux. fuel pumps .... OFF

Use crossfeed in level cruise flight only.

NOTE

Do not crossfeed with full fuel on same side as operating engine since vapor return fuel flow will be lost through the vent system.

LANDING

Fuel selector operating engine .... ON
Fuel selector inop. engine .... OFF

ENGINE DRIVEN FUEL PUMP FAILURE

Throttle .... retard
Aux. fuel pump .... unlatch, on HI
Throttle .... reset (75% power or below)

CAUTION

If normal engine operation and fuel flow is not immediately re-established, the auxiliary fuel pump should be turned off. The lack of a fuel flow indication while on the HI auxiliary fuel pump position could indicate a leak in the fuel system, or fuel exhaustion.

CAUTION

Actuate the auxiliary fuel pumps if vapor suppression is required (LO position) or the engine driven fuel pump fails (HI position). The auxiliary fuel pumps have no standby function. Actuation of the HI switch position when the engine fuel injection system is functioning normally may cause engine roughness due to excessively rich fuel air mixture.

LANDING GEAR UNSAFE WARNINGS

Red light indicates gear in transit.
Recycle gear if indication continues.
Light will illuminate when gear warning horn sounds at low throttle settings.

MANUAL EXTENSION OF LANDING GEAR

Check following before extending gear manually:
Circuit breakers .... check
Battery switch .... ON
Alternators .... check
Navigation lights .... OFF (daytime)

To extend, reposition clip downward clear of knob and proceed as follows:
Airspeed .... reduce (85 KIAS max.)
Gear selector .... GEAR DOWN LOCKED position
Emerg. gear extend knob .... pull
Indicator lights .... 3 green
Leave emergency gear extension knob out.

GEAR UP LANDING

Approach .... Normal
Flaps .... as desired
Throttles .... closed prior to touchdown

Battery switch .... OFF
Fuel selector .... OFF
Touch down at minimum airspeed.

ENGINE FAILURE WITH REAR CABIN AND CARGO DOORS REMOVED

S.E. min. control speed of 67 KIAS for this configuration.

If airspeed is below 67 KIAS reduce power on operating engine to maintain control.

ELECTRICAL FAILURES

ALT warning light illuminated:
Ammeter Ammeters.............................. check L & R check
Electrical load .... reduce to minimum
Alternators.......................... OFF, then ON one at a time

If alternator outputs are NOT restored:
Battery switch .... OFF
Alternator switches..................... OFF, then ON one at a time

If alternator outputs are NOT restored:
Alternator switches.. OFF
Battery switch .... as required

If alternator cannot be restored, reduce electrical load and land as soon as practical. The battery is the only remaining source of electrical power.

WARNING

Compass error may exceed 10 degrees with both alternators inoperative.

NOTE

If battery is depleted, the landing gear must be lowered using the emergency gear extension procedure. Gear position lights will be inoperative.

Electrical overload (alternators over 30 amps above known electrical load):
Electrical load .... reduce

If alternator loads cannot be reduced:
Battery switch .... OFF

If alternator loads are not reduced, land as soon as possible. Anticipate complete electrical power failure.

GYRO SUCTION FAILURES

Pressure below 4.5 in. Hg.
RPM .... increase to 2600
Altitude .... descend to maintain 4.5 in Hg.
Use electric turn indicator to monitor Directional Indicator and Attitude Indicator performance.

SPINS

Throttles .... retard to idle
Rudder .... full opposite to direction of spin
Control wheel .... release back pressure
Control wheel .... full forward if nose does not drop
Ailerons .... neutral
Rudder .... neutralize when rotation stops
Control wheel .... smooth back pressure to recover from dive

EMERGENCY DESCENT

Throttles .... closed
Propellers .... full forward
Mixture .... as required for smooth operation
Landing gear .... extend
Airspeed .... 130 KIAS

COMBUSTION HEATER OVERHEAT

Unit will automatically cut-off.
Do not attempt to restart.

OPEN DOOR (ENTRY DOOR ONLY)

If both upper and side latches are open, the door will trail slightly open and airspeeds will be reduced slightly.

To close the door in flight:
Slow airplane to 90 KIAS.
Cabin vents .... close
Storm window .... open

If upper latch is open .... latch
If side latch is open .... pull on armrest while moving latch handle to latched position

If both latches are open .... latch side latch then top latch

PROPELLER OVERSPEED

Throttle .... retard
Prop control .... full DECREASE rpm, then set if any control available
Airspeed .... reduce
Throttle .... as required to remain below 2600 rpm

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3.5 AMPLIFIED EMERGENCY PROCEDURES (GENERAL)

The following paragraphs are presented to supply additional information for the purpose of providing the pilot with a more complete understanding of the recommended course of action and probable cause of an emergency situation.

3.7 ENGINE INOPERATIVE PROCEDURES

DETECTING A DEAD ENGINE

A loss of thrust will be noted and with coordinated controls, the nose of the aircraft will yaw in the direction of the dead engine.

ENGINE SECURING PROCEDURE (FEATHERING PROCEDURE)

Keep in mind that the one engine inoperative air minimum control speed is 66 KIAS and the one engine inoperative best rate of climb speed is 92 KIAS.

To feather a propeller, maintain direction and an airspeed above 85 KIAS. Move the mixture and propeller controls forward. The throttle controls should be moved forward to maintain a safe airspeed. Retract the flaps and landing gear and identify the inoperative engine. The airplane will yaw in the direction of the dead engine. Retard the throttle of the inoperative engine to verify loss of power.

NOTE

If circumstances permit, in the event of an actual engine failure, the pilot may elect to attempt to restore power prior to feathering.

If circumstances permit an attempt to restore power prior to feathering, adjust the mixture control as required, move the fuel selector control to ON, and select either L (left) or R (right) magneto. Move the ALTERNATE AIR control to ON and the AUX. fuel pump to the ON-HI position. If power is not immediately restored turn off the AUX. fuel pump.

The propellers can be feathered only while the engine is rotating above 800 RPM. Loss of centrifugal force due to slowing RPM will actuate a stop pin that keeps the propeller from feathering each time the engine is stopped on the ground. One engine inoperative performance will decrease if the propeller of the inoperative engine is not feathered.

The propeller control of the inoperative engine should be moved to the feather position and the mixture control of the inoperative engine to idle cut-off.

Trim the aircraft as required and maintain a 3° to 5° bank toward the operating engine. The ball will be ½ to 1 out for minimum drag. The AUX. fuel pumps should be off except in the case of an engine driven fuel pump failure. Turn OFF the magnetos and close the cowl flaps on the inoperative engine. Cowl flaps should be used as necessary on the operative engine. The alternator of the inoperative engine should be turned OFF and the electrical load reduced to prevent depletion of the battery. Move the fuel selector control for the inoperative engine to the OFF position. If necessary, consider the use of crossfeed (refer to Fuel Management During One Engine Inoperative Operation, paragraph 3.11). Turn OFF the operative engine's AUX. fuel pump.

NOTE

When an engine is feathered the alternator, gyro air, and oil annunciator warning lights will remain illuminated.

ENGINE FAILURE DURING TAKEOFF (BELOW 85 KIAS)

The one engine inoperative air minimum control speed for this airplane is 66 KIAS under standard conditions.

If engine failure occurs during takeoff ground roll and 85 KIAS has not been attained, CLOSE both throttles immediately and stop straight ahead. If inadequate runway remains to stop, close the throttles and apply maximum braking. The battery switch and fuel selectors should be turned OFF. Continue path straight ahead turning to avoid obstacles as necessary.

ENGINE FAILURE DURING TAKEOFF (85 KIAS OR ABOVE)

If engine failure occurs during takeoff ground roll or after lift-off with the gear still down and 85 KIAS has been attained, the course of action to be taken will depend on the runway remaining. If adequate runway remains, CLOSE both throttles immediately, land if airborne and stop straight ahead. If the runway remaining is inadequate for stopping, the pilot must decide whether to abort the takeoff or to continue. The decision must be based on the pilot's judgment considering loading, density altitude, obstructions, the weather, and the pilot's competence. If the decision is made to continue the takeoff, maintain heading and airspeed. When climb is established RETRACT the landing gear, accelerate to 92 KIAS, and FEATHER the inoperative engine (refer to Engine Securing Procedure).

WARNING

In certain combinations of aircraft weight, configuration, ambient conditions and speeds, negative climb performance may result. Refer to One Engine Inoperative Climb Performance chart, Figure 5-21.

ENGINE FAILURE DURING FLIGHT (BELOW 66 KIAS)

Should an engine fail during flight at an airspeed below 66 KIAS, apply rudder towards the operative engine to maintain directional control. The throttles should be retarded to stop the yaw force produced by the inoperative engine. Lower the nose of the aircraft to accelerate above 66 KIAS and increase the power on the operative engine as the airspeed exceeds 66 KIAS*.

After an airspeed above 66 KIAS* has been established, an engine restart attempt may be made if altitude permits. If the restart has failed, or if altitude does not permit, the engine should be secured, see Engine Securing Procedure.

*67 KIAS with aft doors removed.

ONE ENGINE INOPERATIVE LANDING

Complete the Engine Securing Procedure. The landing gear should not be extended and the wing flaps should not be lowered until certain of making the field.

Maintain additional altitude and speed during approach, keeping in mind that landing should be made right the first time and that a go-around should be avoided if at all possible.

Establish a final approach speed of 90 KIAS and use wing flaps as required.

WARNING

Under some conditions of loading and density altitude a go-around may be impossible, and in any event the sudden application of power during one engine inoperative operation makes control of the airplane more difficult.

ONE ENGINE INOPERATIVE GO-AROUND

NOTE

A one engine inoperative go-around should be avoided if at all possible.

To execute a one engine inoperative go-around, advance the mixture and propeller levers forward. The throttle should be advanced slowly to 40 in. Hg. manifold pressure. Retract the flaps and landing gear. Maintain airspeed at the one engine inoperative best rate of climb speed of 92 KIAS. Set the trim and cowl flaps as required.

AIR START (UNFEATHERING PROCEDURE)

Move the fuel selector for the inoperative engine to the ON position and check to make sure the AUX fuel pump for that engine is on LO boost. Open the throttle 1/4 inch and the mixtures should be set RICH. Turn ON the magneto switches and push the propeller control latch and propeller control lever full forward. On airplanes equipped with the optional unfeathering system the propeller will start to windmill. On airplanes not so equipped,

engage the starter until the propeller windmills freely. If the engine does not start, prime as necessary. After restart turn OFF the AUX fuel pump, reduce the power until the engine is warm and turn the alternator switch ON.

If required the starter may be used in conjunction with the unfeathering accumulators.

3.9 FIRE

ENGINE FIRE ON THE GROUND

The first attempt to extinguish the fire is to try to draw the fire back into the engine. If the engine has not started move the mixture control to idle cut-off and open the throttle. Begin to crank the engine with the starter in an attempt to pull the fire into the engine.

If the engine has already started and is running, continue operating to try to pull the fire into the engine.

In either case (above), if the fire continues longer than a few seconds the fire should be extinguished by the best available external means.

If an external fire extinguishing method is to be applied move the fuel selector valves to OFF and the mixture to idle cut-off.

ENGINE FIRE IN-FLIGHT

The procedure given below is general and pilot judgment should be the deciding factor for action in such an emergency.

If an engine fire occurs in flight, place the fuel selector of the affected engine in the OFF position. Feather the propeller on the faulty engine. Move the mixture control to idle cut-off. The cowl flap should be open. A landing should be made if terrain permits.

3.11 FUEL MANAGEMENT DURING ONE ENGINE INOPERATIVE OPERATION

A crossfeed is provided to increase range during one engine inoperative operation. Use crossfeed in level flight only.

CRUISING

When using fuel from the fuel tank on the same side as the operating engine the fuel selector of the operating engine should be ON and the fuel selector for the inoperative engine should be OFF. The AUX. fuel pumps should be OFF except in the case of an engine driven fuel pump failure. If an engine driven fuel pump has failed the AUX. fuel pump on the operating engine side must be ON - HI.

Increased range is available by using fuel from the tank on the opposite side of the operating engine. For this configuration the fuel selector of the operating engine should be on X-FEED (crossfeed) and the fuel selector of the inoperative engine should be OFF. The AUX. fuel pumps should be OFF.

NOTE

A vapor return line from each engine will return a percentage of fuel back to the tank on the same side as that engine. Therefore, a minimum of 30 minutes of fuel should be used from this tank before selecting crossfeed. If the tank gauge approaches "FULL," go back to that tank and operate for 30 minutes to bring the fuel level down before returning to crossfeed or fuel may be pumped overboard through the fuel vent.

LANDING

During the landing sequence the fuel selector of the operating engine must be ON and the fuel selector of the inoperative engine OFF. The AUX. fuel pump of the operating engine should be OFF.

3.13 ENGINE DRIVEN FUEL PUMP FAILURE

Should a malfunction of the engine driven fuel pump occur, the auxiliary fuel pump system can supply sufficient fuel pressure for engine power up to approximately 75%. Any combination of RPM and Manifold Pressure defined on the Power Setting Table may be used, but leaning may be required for smooth operation at altitudes above 15,000 feet or for RPM's below 2300. Normal cruise, descent and approach procedures should be used.

Loss of fuel pressure and engine power can be an indication of failure of the engine driven fuel pump. Should these occur and engine driven fuel pump failure is suspected, retard the throttle and unlatch the auxiliary pump and select the HI position. The throttle can then be reset at 75% power or below.

CAUTIONS

If normal engine operation and fuel flow is not immediately re-established, the auxiliary fuel pump should be turned off. The lack of a fuel flow indication while on the HI auxiliary fuel pump position could indicate a leak in the fuel system, or fuel exhaustion.

Actuate the auxiliary fuel pumps if vapor suppression is required (LO position) or the engine driven fuel pump fails (HI position). The auxiliary fuel pumps have no standby function. Actuation of the HI switch position when the engines are operating normally may cause engine roughness and/or power loss.

3.15 LANDING GEAR UNSAFE WARNINGS

The red landing gear light will illuminate when the landing gear is in transition between the full up position and the down and locked position. The pilot should recycle the landing gear if continued illumination of the light occurs. Additionally, the light will illuminate when the gear warning horn sounds. The gear warning horn will sound at low throttle settings if the gear is not down and locked.

3.17 MANUAL EXTENSION OF THE LANDING GEAR

Several items should be checked prior to extending the landing gear manually. Check for popped circuit breakers and ensure the battery switch is ON. Now check the alternators. If it is daytime, turn OFF the navigation lights.

To execute a manual extension of the landing gear, power should be reduced to maintain airspeed below 85 KIAS. Place the landing gear selector switch in the GEAR DOWN position and pull the emergency gear extension knob. Check for 3 green indicator lights.

WARNING

If the emergency gear extension knob has been pulled out to lower the gear due to a gear system malfunction, leave the control in its extended position until the airplane has been put on jacks to check the proper function of the landing gears hydraulic and electrical systems.

3.19 GEAR-UP EMERGENCY LANDING

An approach should be made with power at a normal airspeed with the flap position to be used at the pilot's discretion. Flaps up will reduce wing flap damage. Close the throttles just before touchdown. Turn OFF the battery and ignition switches and move the fuel selector valve controls to OFF. Contact to the surface should be made at a minimum airspeed.

3.21 ENGINE FAILURE WITH REAR CABIN AND CARGO DOORS REMOVED

The minimum single engine control speed for this configuration is 67 KIAS. If engine failure occurs at an airspeed below 67 KIAS, reduce power as necessary on the operating engine and apply rudder to maintain directional control.

3.23 ELECTRICAL FAILURES

S/N 34-8133001 THRU 34-8233205

If an ALT annunciator light illuminates, observe the ammeters to determine which alternator is inoperative. If both ammeters show zero output, reduce electrical loads to the minimum. Turn OFF both alternator switches and then turn them momentarily ON one at a time while observing the ammeters. The alternator showing the LEAST (but not zero) current should be turned ON. The other alternator should be left OFF. Electrical

loads may be reinstated as required to a maximum of 60 amperes. If both alternator outputs cannot be restored, both alternator switches should be left OFF. Reduce the electrical load to essential systems and land as soon as practical. The battery is the only remaining source of electrical power.

If one ammeter shows zero output, cycle its switch OFF and then ON. If this fails to restore output check the circuit breakers. The breakers may be reset once if required. If the alternator remains inoperative reduce electrical loads if necessary and exercise judgment regarding continued flight.

Corrective maintenance actions should be performed prior to further flights.

NOTE

The markings on the ammeters (loadmeters) require mental interpolations to estimate the ampere values noted. Operating the alternators at less than 60 amperes will assure that the battery will not be depleted.

WARNING

Compass error may exceed 10° with both alternators inoperative.

If abnormally high alternator outputs are observed and persists (more than 30 amps above known electrical loads) they may be caused by a low battery, a battery fault, or other abnormal electrical load. If it is caused by a low battery the indication should begin to decrease towards normal within 5 minutes. If this condition is observed proceed with the following. Turn the battery switch OFF and the alternator output indications should decrease. Turn the battery switch ON. Should the alternator output indications not decrease, leave the battery switch OFF and land as soon as practical. All electrical load is being supplied by the alternators. Also anticipate complete electrical power failure.

NOTE

Operation with the alternator ON and the battery switch OFF should be made only when required by electrical failure, due to increased system voltage and radio frequency noise.

S/N 34-8333001 AND UP

If an ALT annunciator light illuminates, check the output of each alternator individually, using the prss-to-test buttons located on either side of the ammeter to determine which alternator is inoperative. If both alternators show zero output, reduce electrical loads to the minimum. Turn OFF both alternator switches and then turn them momentarily ON one at a time while observing alternator output. The alternator showing the LEAST (but not zero) current should be turned ON. The other alternator should be left OFF. Electrical loads may be reinstated as required to a maximum of 60 amperes. If both alternator outputs cannot be restored, both alternator switches should be left OFF. Reduce the electrical load to essential systems and land as soon as practical. The battery is the only remaining source of electrical power.

If one alternator shows zero output, cycle its switch OFF and then ON. If this fails to restore output check the circuit breakers. The breakers may be reset once if required. If the alternator remains inoperative reduce electrical loads if necessary and exercise judgment regarding continued flight.

When the ammeter needle indicates to the left of center, the battery is being discharged; when the needle indicates to the right of center, the battery is being charged. During single alternator operation the feature can be used to determine how much the electrical load should be reduced.

Corrective maintenance actions should be performed prior to further flights.

NOTE

The markings on the ammeter (loadmeter) require mental interpolations to estimate the ampere values noted. Operating the alternators at less than 60 amperes will assure that the battery will not be depleted.

WARNING

Compass error may exceed 10° with both alternators inoperative.

If abnormally high alternator outputs are observed and persists (more than 30 amps above known electrical loads) they may be caused by a low battery, a battery fault, or other abnormal electrical load. If it is caused by a low battery the indication should begin to decrease towards normal within 5 minutes. If this condition is observed proceed with the following. Turn the battery switch OFF and the alternator output indications should decrease. Turn the battery switch ON. Should the alternator output indications not decrease, leave the battery switch OFF and land as soon as practical. All electrical load is being supplied by the alternators. Also anticipate complete electrical power failure.

NOTE

Operation with the alternator ON and the battery switch OFF should be made only when required by electrical failure, due to increased system voltage and radio frequency noise.

3.25 GYRO SUCTION FAILURES

A malfunction of the instrument suction system will be indicated by a reduction of the suction reading on the gauge. In the event of a vacuum system failure or a feathered engine, a low vacuum warning light on the annunciator panel will illuminate.

In the event of a suction system malfunction, (suction lower than 4.5 inches of mercury) increase engine RPM to 2600. Descend to an altitude at which 4.5 inches of mercury suction can be maintained, if possible. The electric turn indicator should be used to monitor the performance of the directional and attitude indicators.

3.27 SPINS

Intentional spins are prohibited in this airplane. In the event a spin is encountered unintentionally, immediate recovery actions must be taken.

To recover from an unintentional spin, immediately retard the throttles to the idle position. Apply full rudder opposite the direction of the spin rotation. Let up all back pressure on the control wheel. If the nose does not drop, immediately push the control wheel full forward. Keep the ailerons neutral. Maintain the controls in these positions until spin rotation stops, then neutralize the rudder. Recovery from the resultant dive should be with smooth back pressure on the control wheel. No abrupt control movement should be used during recovery from the dive, as the positive limit maneuvering load factor may be exceeded.

NOTE

Federal Aviation Administration Regulations do not require spin demonstration of multi-engine airplanes; therefore, spin tests have not been conducted. The recovery technique presented is based on the best available information.

3.29 EMERGENCY DESCENT

In the event an emergency descent becomes necessary, CLOSE the throttles and move the propeller controls full FORWARD. Adjust the mixture controls as necessary to attain smooth operation. Extend the landing gear at 130 KIAS and maintain this airspeed.

3.31 COMBUSTION HEATER OVERHEAT

In the event of an overheat condition, the fuel, air and ignition to the heater is automatically cut off. Do not attempt to restart the heater until it has been inspected and the cause of the malfunction has been determined and corrected.

3.33 OPEN DOOR (ENTRY DOOR ONLY)

The cabin door is double latched, so the chances of its springing open in flight at both the top and side are remote. However, should you forget the upper latch, or not fully engage the side latch, the door may spring partially open. This will usually happen at takeoff or soon afterward. A partially open door will not affect normal flight characteristics, and a normal landing can be made with door open.

If both upper and side latches are open, the door will trail slightly open, and airspeed will be reduced slightly.

To close the door in flight, slow the airplane to 90 KIAS, close the cabin vents and open the storm window. If the top latch is open, latch it. If the side latch is open, pull on the armrest while moving the latch handle to the latched position. If both latches are open, close the side latch then the top latch.

3.35 PROPELLER OVERSPEED

Propeller overspeed is usually caused by a malfunction in the propeller governor which allows the propeller blades to rotate to full low pitch.

If propeller overspeed should occur, retard the throttle. The propeller control should be moved to full "DECREASE rpm" and then set if any control is available. Airspeed should be reduced and throttle used to maintain 2600 RPM.

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SECTION 4

NORMAL PROCEDURES

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SECTION 4

NORMAL PROCEDURES

4.1 GENERAL

This section describes the recommended procedures for normal operations for the Seneca III. Required (FAA regulations) procedures and those necessary for the operation of the airplane as determined by the operating and design features of the airplane are presented.

Normal procedures associated with those optional systems and equipment which require handbook supplements are provided by Section 9 (Supplements).

These procedures are provided to present a source of reference and review and to supply information on procedures which are not the same for all aircraft. Pilots should familiarize themselves with the procedures given in this section in order to become proficient in the normal operations of the airplane.

The first portion of this section consists of a short form checklist which supplies an action sequence for normal operations with little emphasis on the operation of the systems.

The remainder of the section is devoted to amplified normal procedures which provide detailed information and explanations of the procedures and how to perform them. This portion of the section is not intended for use as an in-flight reference due to the lengthy explanations. The short form checklist should be used for this purpose.

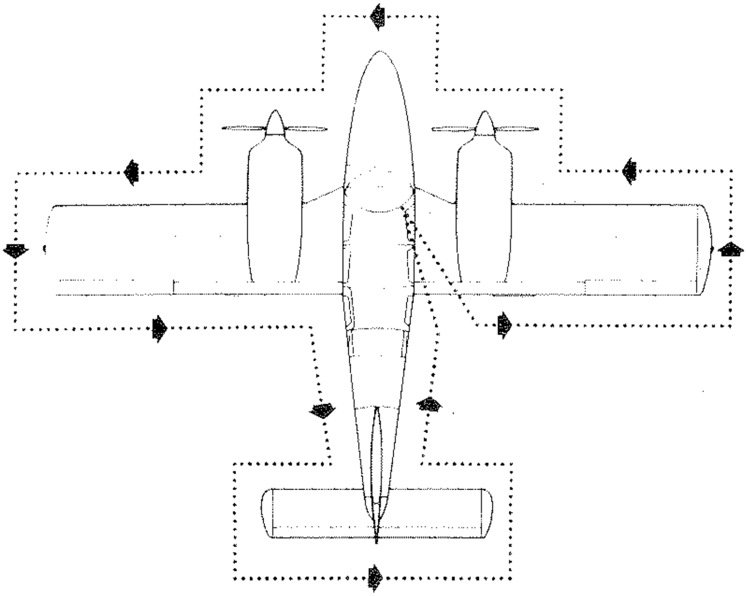
All data given is for both two and three blade propellers unless otherwise noted.

4.3 AIRSPEEDS FOR SAFE OPERATIONS

The following airspeeds are those which are significant to the operation of the airplane. These figures are for standard airplanes flown at gross weight under standard conditions at sea level.

Performance for a specific airplane may vary from published figures depending upon the equipment installed, the condition of the engine, airplane and equipment, atmospheric conditions and piloting technique.

(a) Best Rate of Climb Speed	92 KIAS
(b) Best Angle of Climb Speed	76 KIAS
(c) Turbulent Air Operating Speed (See Subsection 2.3)	140 KIAS
(d) Maximum Flap Speed	115 KIAS
(e) Landing Final Approach Speed (Flaps 40°) Short Field Effort	82 KIAS
(f) Intentional One Engine Inoperative Speed	85 KIAS
(g) Maximum Demonstrated Crosswind Velocity	17 KTS



WALK-AROUND
Figure 4-1

4.5 NORMAL PROCEDURES CHECKLIST

PREPARATION

Airplane status .... airworthy, papers on board
Weather .... suitable
Baggage .... weighed, stowed, tied
Weight and C.G. .... within limits
Navigation .... planned
Charts and navigation equipment .... on board
Performance and range .... computed and safe

PREFLIGHT CHECK

INSIDE CABIN

Landing gear control .... DOWN position
Avionics .... OFF

Battery switch .... ON
Landing gear lights.....................................3 GREEN
Fuel quantity ....adequate plus reserve
Cowl flaps ....OPEN
Battery switch .... OFF
Ignition switches .... OFF
Mixture controls .... idle cut-off
Trim indicators .... neutral
Flaps ....check operation
Controls .... free
Pitot and static systems .... drain
Empty seats ....fasten belts
Crossfeed drains .... drain

OUTSIDE CABIN

Crossfeed drains ....check, closed
Right wing, aileron and flap ....check, no ice
Right main gear ....no leaks
Strut ....proper inflation
Tire ....check
Right wing tip ....check
Right leading edge ....check, no ice
Fuel cap ....open, check quantity and color, secure
Right engine nacelle ....check oil
Right propeller ....check
Cowl flaps ....OPEN and secure
Fuel drains ....drain
Nose section ....check
Nose gear ....no leaks
Strut ....proper inflation
Tire ....check
Tow bar ....removed and stowed
Landing lights ....check
Windshield ....clean
Left wing, engine nacelle and landing gear ....check as on right side
Stall warning vanes ....check
Pitot mast ....clear, checked
Dorsal fin air scoop ....clear
Rear doors ....latched
Left static vent ....clear
Empennage ....check, no ice

Stabilator .... free
Antennas .... check
Navigation and landing lights .... check
Right static vent .... clear

BEFORE STARTING ENGINES

Seats .... adjusted, secure
Seat belts and harness .... fasten adjust - check inertia reel
Parking brake .... set

WARNING

No braking will occur if knob is pulled before brake application.

Circuit breakers .... in
Radios .... OFF
Cowl flaps .... OPEN
Alternate air .... OFF
Alternators .... ON

STARTING ENGINES (AIRPLANE EQUIPPED WITH STANDARD PRIMER SYSTEM)

Fuel selector .... ON
Mixture .... FULL RICH
Throttle .... half travel
Prop control .... FULL FORWARD
Battery switch .... ON
Ignition switches (mags) .... ON
Propeller .... clear
Starter .... engage
Primer .... as required
Throttle .... adjust when engine starts
Oil pressure .... check
Repeat for opposite engine.
Alternators .... check
Gyro suction .... check

NOTE

When starting at ambient temperatures +20°F and below, operate first engine started with alternator ON (at max charging rate not to exceed 1500 RPM) for 5 minutes minimum before initiating start on second engine.

STARTING ENGINES (AIRPLANE EQUIPPED WITH OPTIONAL ENGINE PRIMER SYSTEM)

Fuel selector .... ON
Mixture .... FULL RICH
Throttle .... FULL FORWARD
Prop control .... FULL FORWARD
Battery switch .... ON
Ignition switches (mags) .... ON
Auxiliary fuel pump .... OFF
Primer .... ON
See Figure 4-3 for Priming Time
Throttle .... CLOSE
Starter .... engage
At temperatures below +20°F continue priming while cranking until engine starts.

When engine starts & accelerates thru 500 RPM:
Starter .... release
Throttle .... advance slowly to obtain 1000 RPM
Primer .... release
Auxiliary fuel pump .... low only as necessary to obtain smooth engine operation (1-3 minutes will be required when temp. is below +20°F)
Oil pressure .... check
Repeat for opposite engine.
Alternators .... check
Gyro suction .... check

NOTE

When starting at ambient temperatures +20°F and below, operate first engine started with alternator ON (at max charging rate not to exceed 1500 RPM) for 5 minutes minimum before initiating start on second engine.

STARTING ENGINES WHEN FLOODED

Mixture .... idle cut-off
Throttle .... FULL FORWARD
Propeller .... FULL FORWARD
Battery switch .... ON
Ignition switches (mags) .... ON
Auxiliary fuel pump .... OFF
Propeller .... clear
Starter .... engage

When engine fires:
Throttle .... retard
Mixture .... advance slowly

STARTING ENGINES IN COLD WEATHER (AIRPLANE EQUIPPED WITH STANDARD ENGINE PRIMER SYSTEM)

Ignition switches .... OFF
Props .... turn through by hand (3 times)
Fuel selector .... ON
Mixture .... FULL RICH
Throttle .... FULL FORWARD
Prop control .... FULL FORWARD
Battery switch .... ON
Ignition switches (mags) .... ON
Auxiliary fuel pump .... ON LO boost
Starter .... engage
Primer .... ON 3 sec.
Throttle .... FULL FORWARD to FULL AFT
Primer .... ON 3 sec., then OFF 3 sec., then ON 3 sec.

When engine fires:
Starter .... leave engaged
Primer button .... tap until rhythmic firing
Starter .... release
Throttle .... half travel
Oil pressure .... check

If engine begins to falter:
Primer button .... tap
Throttle .... 1000 RPM
Auxiliary fuel pump .... OFF after start complete

STARTING ENGINES WITH EXTERNAL POWER

Battery switch .... OFF
All electrical equipment .... OFF
Terminals .... connect
External power plug .... insert in fuselage
Proceed with normal start.
Throttles .... lowest possible RPM
External power plug .... disconnect from fuselage
Battery switch .... ON - check ammeter
Oil pressure .... check

WARM-UP

Throttles .... 1000 to 1200 RPM

TAXIING

Chocks .... removed
Parking brake .... release
Taxi area .... clear
Throttle .... apply slowly
Brakes .... check
Steering .... check
Instruments .... check
Heater and defroster .... check
Fuel selector .... ON, check crossfeed
Autopilot .... OFF

BEFORE TAKEOFF - GROUND CHECK

Parking brake . . . . set
Mixture controls . . . . FORWARD
Prop controls . . . . FORWARD
Throttle controls . . . . 1000 RPM
Manifold pressure lines . . . . drain
Prop controls . . . . check feathering, 300 RPM max. drop
Throttle controls . . . . 2300 RPM
Prop controls . . . . check governor
Prop controls . . . . FORWARD
Alternate air . . . . ON then OFF
Throttle controls . . . . 2000 RPM
Magnetos . . . . check, max. drop 150 RPM, max. diff. drop 50 RPM
Alternator output . . . . check
Gyro suction gauge . . . . 4.8 to 5.1 in. Hg.
Throttles . . . . 800-1000 RPM
Fuel selectors . . . . ON
Alternators . . . . ON
Engine gauges . . . . in the green
Annunciator panel . . . . press-to-test
Flight instruments . . . . set
Mixtures . . . . set
Quadrant friction . . . . ADJUSTED
Alternate air . . . . OFF
Cowl flaps . . . . set
Seat backs . . . . erect
Wing flaps . . . . set
Trim . . . . set
Belts/harness . . . . fastened/adjusted
Empty seats . . . . seat belts fastened
Controls . . . . free, full travel
Doors . . . . latched
Auxiliary fuel pumps . . . . OFF
Pitot heat . . . . as required
Parking brake . . . . release

TAKEOFF

CAUTION

Fast taxi turns immediately prior to takeoff run should be avoided.

Adjust mixture prior to takeoff from high elevations. Do not overheat. Adjust mixture only enough to obtain smooth engine operation. Do not exceed 40 in. Hg. manifold pressure.

NORMAL TAKEOFF (Flaps up)

Brakes . . . . apply and hold
Flaps . . . . UP
Brakes . . . . release
Accelerate to and maintain 79 KIAS.
Control wheel . . . . ease back to rotate to climb attitude
After obstacle clearance, accelerate to best rate of climb speed of 92 KIAS.
Gear . . . . UP

SHORT FIELD TAKEOFF (25° Flaps)

Flaps . . . . 25° (second notch)
Stabilator trim . . . . set
Brakes . . . . apply and hold
Takeoff power before brake release.
Brakes . . . . release
Accelerate to 64 KIAS.
Control wheel . . . . rotate firmly to attain 66 KIAS through 50 ft.
Gear . . . . UP

APPROACH AND LANDING

Gear warning horn .... check
Seat backs .... erect
Belts/harness .... fasten/adjust
Fuel selectors .... ON
Cowl flaps .... as required
Auxiliary fuel pumps .... OFF
Mixture controls .... rich
Prop controls .... FULL FORWARD
Landing gear .... DOWN, 130 KIAS max.
Flaps .... set, 115 KIAS max.
Approach speed .... 90 KIAS or above

GO-AROUND

Full takeoff power, both engines. (40 in. Hg, maximum manifold pressure)
Establish positive climb.
Flaps .... retract
Gear .... UP
Cowl flaps .... adjust

AFTER LANDING

Clear of runway.
Flaps .... retract
Cowl flaps .... fully OPEN

SHUTDOWN

Heater (if ON) .... FAN, 2 min. then OFF
Radios & electrical .... OFF
Throttle .... full aft
Mixture .... idle cut-off
Magnetos .... OFF
Battery switch .... OFF

CLIMB

TAKEOFF CLIMB

Best rate (flaps up) ....92 KIAS
Best angle (flaps up).......................................76 KIAS
En route ....102 KIAS
Cowl flaps ....as required
Power ....reduce to MCP

CRUISE CLIMB

Mixture ....full RICH
Power 75%
Climb speed ....102 KIAS
Cowl flaps ....as required

CRUISING

Power ....set per power table
Mixture controls....................................... adjust
Cowl flaps ....as required

DESCENT

Mixtures.......................................adjust with descent
Throttles....................................... set
Cowl flaps .... CLOSED

MOORING

Parking brake . . . . as required
Control wheel . . . . secured with belts
Flaps . . . . full up
Wheel chocks . . . . in place
Tie downs . . . . secure

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4.7 AMPLIFIED NORMAL PROCEDURES (GENERAL)

The following paragraphs are provided to supply detailed information and explanations of the normal procedures necessary for the operation of the airplane.

4.9 PREPARATION

The airplane should be given a thorough preflight and walk-around check. The preflight should include a determination of the airplane's operational status, a check that necessary papers and charts are on board and in order, and a computation of weight and C.G. limits, takeoff distance and in-flight performance. Baggage should be weighed, stowed and tied down. Passengers should be briefed on the use of seat belts and shoulder harnesses, oxygen, and ventilation controls, advised when smoking is prohibited, and cautioned against handling or interfering with controls, equipment, door handles, etc. A weather briefing for the intended flight path should be obtained, and any other factors relating to a safe flight should be checked before takeoff.

4.11 PREFLIGHT CHECK

CAUTION

The flap position should be noted before boarding the airplane. The flaps must be placed in the "UP" position before they will lock and support weight on the step.

Upon entering the cockpit, check that the landing gear selector is in the DOWN position, turn OFF all avionics equipment (to save power and prevent wear on the units), and turn the battery switch ON. Check the landing gear indicator lights to ensure that the three green lights have illuminated and that the red light has not illuminated. Check the fuel supply. Adequate fuel should be indicated for the flight plus reserve. The cowl flaps should be OPEN to facilitate inspection and ensure cooling after engine start. Return the battery switch to OFF to save the battery.

Check that the ignition switches are OFF and move the mixture controls to idle cut-off to prevent an inadvertent start while checking the propellers. Move the trim controls to neutral so that the tabs can be checked for alignment. Extend and retract the flaps to check for proper operation. This check is performed prior to engine start so that you can hear any noise that might indicate binding. The controls should be free and move properly. Drain the pitot and static system lines through the drains located on the side panel next to the pilot's seat. Fasten the seat belts on the empty seats. Before leaving the cockpit, drain the two crossfeed drains on the forward side of the spar box.

The first item to check during the walk-around is to ensure that the crossfeed drains are closed. Check the right wing, aileron and flap hinges and surfaces for damage and ice. Make a close check of the right landing gear for leaks, proper piston exposure under a static load (3-1/2 inches) and that the tires are properly inflated and not excessively worn. The right wing tip and leading edge should be free from ice and damage.

Open the fuel cap to check the quantity and color of the fuel and cap vent. The vent should be free of obstructions. Secure the fuel cap properly. Proceeding around to the engine nacelle, check the oil quantity (six to eight quarts). Make sure that the dipstick has properly seated after checking. Check and ensure that the oil filler cap is securely tightened and secure the inspection door. Check the right propeller for nicks or leaks. The spinner should be secure and undamaged (check closely for cracks). The cowl flaps should be open and secure.

The right fuel drains should be opened to drain moisture and sediment. Drain the two fuel tank drains under the wing and the gascolator drain near the bottom of the engine nacelle (refer to Section 8 for more detailed draining procedure).

Check the nose section for damage and the nose landing gear for leaks and proper strut inflation. Under a normal static load, 2-1/2 inches of strut should be exposed. Check the tire for wear and proper inflation. If the tow bar was used, remove and stow. Before moving on to the forward baggage compartment, check the condition of the landing light. Open the forward baggage compartment and check to make sure that the baggage has been stowed properly. Close, secure and lock the baggage door.

At the front of the airplane, the windshield should be clean, secure and free from cracks or distortion. Moving around to the left wing, check the wing, engine nacelle and landing gear as described for the right side. Don't forget to check the fuel and oil.

If a pitot cover was installed, it should be removed before flight and the holes checked for obstructions. With the heated pitot switch on, check the heated pitot head and heated lift detector for proper heating. Check the stall warning vanes for freedom of movement and damage.

A squat switch in the stall warning system does not allow the units to be activated on the ground.

CAUTION

Care should be taken when an operational check of the heated pitot head and the heated lift detectors is being performed. Both units become very hot. Ground operation should be limited to 3 minutes maximum to avoid damaging the heating elements.

Latch the rear door securely and check the left static vent and dorsal fin air scoop for obstructions. The empennage should be free of ice and damage, and all hinges should be secure. Check the stabilator for freedom of movement and ensure that the right static vent is unobstructed. Antennas should be secure and undamaged. After turning on the battery switch and light switches in the cockpit, check the navigation and landing lights.

4.13 BEFORE STARTING ENGINES

Before starting engines, adjust the seats and fasten the seat belts and shoulder harnesses.

NOTES

> If the fixed shoulder harness (non-inertia reel type) is installed, it must be connected to the seat belt and adjusted to allow proper accessibility to all controls, including fuel selectors, flaps, trim, etc., while maintaining adequate restraint for the occupant.
>
> If the inertia reel type shoulder harness is installed, a pull test of its locking restraint feature should be performed.

Set the parking brake by first depressing and holding the toe brake pedals and then pulling out the parking brake knob.

WARNING

> No braking will occur if knob is pulled prior to brake application.

Check to make sure all the circuit breakers are in and the radios are OFF. Cowl flaps should be OPEN and alternate air OFF. The alternators should now be switched ON.

4.15 STARTING ENGINES (AIRPLANE EQUIPPED WITH STANDARD ENGINE PRIMER SYSTEM)

The first step in starting is to move the fuel selector to the ON position. Advance the mixture control to full RICH, open the throttle half travel and move the propeller control full FORWARD. Turn the battery switch and ignition switches ON. After ensuring that the propellers are clear, engage the starter. The primer button should be used (ON) as required. For cold weather starts, refer to paragraph 4.21 - Starting Engines in Cold Weather. When the engine starts, retard the throttle and monitor the oil pressure gauge. If no oil pressure is indicated within 30 seconds, shut down the engine and have it checked. In cold weather it may take somewhat longer for an oil pressure indication. Repeat the above procedure for the opposite engine. After the engines have started, check the alternators for sufficient output and the gyro suction gauge for a reading between 4.8 and 5.1 in. Hg.

NOTE

To prevent starter damage, limit starter cranking to 30-second periods. If the engine does not start within that time, allow a cooling period of several minutes before engaging starter again. Do not engage the starter immediately after releasing it. This practice may damage the starter mechanism.

4.17 STARTING ENGINES (AIRPLANE EQUIPPED WITH OPTIONAL ENGINE PRIMER SYSTEM)

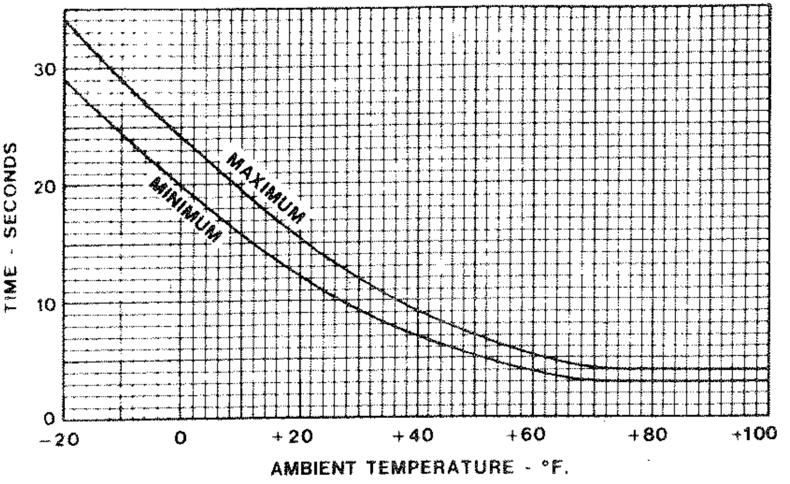
NOTE

Engine starts can be accomplished down to ambient temperatures of +20° F with engines equipped with standard (massive electrode) spark plugs. Below that temperature fine wire spark plugs are highly recommended to ensure engine starts, and are a necessity at +10° F and below. In addition, the use of external electrical power source and preheat is also recommended when ambient temperatures are below +20° F.

Upon entering the cockpit, begin starting procedure by moving the fuel selector to ON. Advance the mixture to full RICH and the throttle and prop controls to full FORWARD. Turn the battery switch and the ignition switches (mag.) ON. The auxiliary fuel pump should be OFF. Push primer switch and hold for the required priming time (see Figure 4-3). Close throttle and immediately engage starter. With ambient temperatures above +20° F, starts may be made by discontinuing priming before engaging starter. With ambient temperatures below +20° F, starts should be made by continuing to prime during cranking period. Do not release starter until engine accelerates through 500 RPM, then SLOWLY advance throttle to obtain 1000 RPM. Release primer and immediately place auxiliary fuel pump switch to LO. Auxiliary fuel pump operation will be required for one to three minutes during initial engine warm-up. When starting at ambient temperatures of +20° F and below, operate the first engine started with alternator ON (at maximum charging rate not to exceed 1500 RPM) for 5 minutes minimum before initiating start on second engine.

NOTE

When cold weather engine starts are made without the use of engine preheating (refer to TCM Operator's Manual), longer than normal elapsed time may be required before an oil pressure indication is observed.



OPTIONAL ENGINE PRIMER SYSTEM - PRIMING TIME VS. AMBIENT TEMPERATURE
Figure 4-3

4.19 STARTING ENGINES WHEN FLOODED

If an engine is flooded, move the mixture control to idle cut-off and advance the throttle and propeller controls full forward. Turn ON the battery switch and ignition switches. The auxiliary fuel pump should be OFF. After ensuring that the propeller is clear, engage the starter. When the engine fires, retard the throttle and advance the mixture slowly.

4.21 STARTING ENGINES IN COLD WEATHER (AIRPLANE EQUIPPED WITH STANDARD ENGINE PRIMER SYSTEM)

NOTE

It may be necessary to apply an external power source and preheat to facilitate engine cranking if the aircraft's battery is deficient of charge.

Prior to attempting the start, turn the propellers through by hand three times after ensuring that the magneto switches are off and mixture controls are in the full aft position. Upon entering the cockpit, begin the starting procedure by moving the fuel selector to ON. Advance the mixture to full RICH and the throttle and prop controls to full FORWARD. Turn ON the battery switch and the ignition switches (mags). The auxiliary fuel pump should be ON in the LO boost position. Push the primer button and engage the starter simultaneously. Begin moving the throttle control back and forth from full forward to full aft. Release the primer button after about 3 seconds of cranking. Leave the primer button off for 3 seconds of cranking and then reapply primer for about 3 seconds, repeat until the engine begins to fire.

When the engine begins firing, leave the starter engaged and tap the primer periodically until a rhythmic firing pattern is observed and then release the starter switch and position the throttle at half travel. Tap the primer button if the engine begins to falter during this period and adjust the throttle to a 1000 RPM idle speed.

The auxiliary fuel pump may be turned OFF as soon as it is determined that the engine will continue to run without it.

4.23 STARTING ENGINES WITH EXTERNAL POWER

An optional feature called the Piper External Power (PEP) allows the operator to use an external battery to crank the engines without having to gain access to the airplane's battery.

Turn the battery switch OFF and turn all electrical equipment OFF. Connect the RED lead of the PEP kit jumper cable to the POSITIVE (+) terminal of an external 12-volt battery and the BLACK lead to the NEGATIVE (-) terminal. Insert the plug of the jumper cable into the socket located on the fuselage. Note that when the plug is inserted, the electrical system is ON. Proceed with the normal starting technique.

After the engines have started, reduce power to the lowest possible RPM, to reduce sparking, and disconnect the jumper cable from the aircraft. Turn the battery switch ON and check the alternator ammeter for an indication of output. DO NOT ATTEMPT FLIGHT IF THERE IS NO INDICATION OF ALTERNATOR OUTPUT.

NOTE

For all normal operations using the PEP jumper cables, the battery switch should be OFF, but it is possible to use the ship's battery in parallel by turning the battery switch ON. This will give longer cranking capabilities, but will not increase the amperage.

CAUTION

If the ship's battery has been depleted, the external power supply can be reduced to the level of the ship's battery. This can be tested by turning the battery switch ON momentarily while the starter is engaged. If cranking speed increases, the ship's battery is at a higher level than the external power supply. If the battery has been depleted by excessive cranking, it must be recharged before the second engine is started. All the alternator current will go to the low battery until it receives sufficient charge, and it may not start the other engine immediately.

4.25 PREHEATING

The use of preheat and auxiliary power (battery cart) will facilitate starting during cold weather and is recommended when the engine has been cold soaked at temperatures of 10°F and below in excess of two hours. Successful starts without these aids can be expected at temperatures below normal, provided the aircraft battery is in good condition and the ignition and fuel systems are properly maintained.

The following procedures are recommended for preheating, starting, warm-up, run-up and takeoff.

(a) Select a high volume hot air heater. Small electric heaters which are inserted into the cowling "bug eye" do not appreciably warm the oil and may result in superficial preheating.

WARNING

Superficial application of preheat to a cold-soaked engine can have disastrous results.

A minimum of preheat application may warm the engine enough to permit starting but will not de-congeal oil in the sump, lines, cooler, filter, etc. Typically, heat is applied to the upper portion of the engine for a few minutes after which the engine is started and normal operation is commenced. The operator may be given a false sense of security by indications of oil and cylinder temperatures as a result of preheat. Extremely hot air flowing over the cylinders and oil temperature thermocouples may lead one to believe the engine is quite warm; however, oil in the sump and filter are relatively remote and will not warm as rapidly as a cylinder. For example, even when heat is applied directly, oil lines are usually "lagged" with material which does an excellent job of insulating.

Congealed oil in such lines may require considerable preheat. The engine may start and apparently run satisfactorily, but can be damaged from lack of lubrication due to congealed oil in various parts of the system. The amount of damage will vary and may not become evident for many hours. On the other hand, the engine may be severely damaged and could fail shortly following application of high power. Improper or insufficient application of preheat and the

resulting oil and cylinder temperature indications may encourage the pilot to expedite his ground operation and commence a takeoff prematurely. This procedure only compounds an already bad situation.

Proper procedures require thorough application of preheat to all parts of the engine. Hot air should be applied directly to the oil sump and external oil lines as well as the cylinders, air intake and oil cooler. Excessively hot air can damage non-metallic components such as seals, hoses and drive belts, so do not attempt to hasten the preheat process.

Before starting is attempted, turn the engine by hand or starter until it rotates freely. After starting, observe carefully for high or low oil pressure and continue the warm-up until the engine operates smoothly and all controls can be moved freely. Do not close the cowl flaps to facilitate warm-up as hot spots may develop and damage ignition wiring and other components.

(b) Hot air should be applied primarily to the oil sump and filter area. The oil drain plug door or panel may provide access to these areas. Continue to apply heat for 15 to 30 minutes and turn the propeller, by hand, through 6 or 8 revolutions at 5 or 10 minute intervals.

(c) Periodically feel the top of the engine and, when some warmth is noted, apply heat directly to the upper portion of the engine for approximately five minutes. This will provide sufficient heating of the cylinders and fuel lines to promote better vaporization for starting. If enough heater hoses are available, continue heating the sump area. Otherwise, it will suffice to transfer the source of heat from the sump to the upper part of the engine.

(d) Start engine immediately after completion of the preheating process. Since the engine will be warm, use normal starting procedure.

NOTE

Since the oil in the oil pressure gauge line may be congealed, as much as 60 seconds may elapse before oil pressure is indicated. If oil pressure is not indicated within one minute, shut the engine down and determine the cause.

(e) Operate the engine at 1000 RPM until some oil temperature is indicated. Monitor oil pressure closely during this time and be alert for a sudden increase or decrease. Retard throttles, if necessary, to maintain oil pressure below 100 psi. If oil pressure drops suddenly to less than 30 psi, shut down the engine and inspect lubrication system. If no damage or leaks are noted, preheat the engine for an additional 10 to 15 minutes before restarting.

4.27 WARM-UP

Warm-up the engines at 1000 to 1200 RPM. Avoid prolonged idling at low RPM, as this practice may result in fouled spark plugs.

Takeoff may be made as soon as the ground check is completed, provided that the throttles may be opened fully without backfiring or skipping, and without a reduction in engine oil pressure.

Do not operate the engines at high RPM when running up or taxiing over ground containing loose stones, gravel or any loose material that may cause damage to the propeller blades.

4.29 TAXIING

Remove chocks from the wheels. Release the parking brake by first depressing and holding the toe brake pedals and then pushing in on the parking brake knob. Check to make sure the taxi area is clear. Always apply the throttles slowly.

Before taxiing, the brakes should be checked by moving forward a few feet, throttling back and applying pressure on the toe pedals. As much as possible, turns during taxiing should be made using rudder pedal motion and differential power (more power on the engine on the outside of the turn, less on the inside engine) rather than brakes.

During the taxi, check the instruments (turn indicator, directional gyro, coordination ball, compass) and the heater and defroster. Check the operation of the fuel management controls by moving each fuel selector to CROSSFEED for a short time, while the other selector is in the ON position. Return the selectors to the ON position. DO NOT attempt a takeoff with the fuel selector on CROSSFEED. The autopilot (if installed) should be off during taxi.

4.31 BEFORE TAKEOFF - GROUND CHECK

A thorough check should be made before takeoff, using a checklist. Before advancing the throttle to check the magnetos and the propeller action, be sure that the engine oil temperature is 75°F or above.

During engine run-up, head the airplane into the wind if possible (see crosswind limits for propellers) and set the parking brake. Advance the mixture and propeller controls forward and the throttle controls to 1000 RPM. Drain the manifold pressure lines by depressing the drain valves located behind and below the dual manifold pressure gauge for 5 seconds. Do not depress the valves when the manifold pressure exceeds 25 inches Hg. Check the feather position of the propellers by bringing the controls fully aft and then full forward. Do not allow more than a 300 RPM drop during the feathering check. Move the throttles to 2300 RPM and exercise the propeller controls to check the function of the governor. Retard control until a 200 to 300 drop in RPM is indicated. This should be done three times on the first flight of the day. The governor can be checked by retarding the propeller control until a drop of 100 RPM to 200 RPM appears, then advancing the throttle to get a slight increase in manifold pressure. The propeller speed should stay the same when the throttle is advanced, thus indicating proper function of the governor.

Return the propeller controls to full forward position and move the alternate air controls to ON then OFF. Move the throttles to 2000 RPM and check the magnetos. The normal drop on each magneto is 100 RPM and the maximum drop should not exceed 150 RPM. The maximum differential drop should not exceed 50 RPM. The alternator output should be approximately equal for both alternators. A 4.8 to 5.1 in. Hg. indication on the gyro suction gauge signifies proper operation of the gyro suction system.

CAUTION

Ensure that the alternators are not indicating full charge prior to takeoff.

Set the throttles between 800 and 1000 RPM, check that the fuel selectors and alternator switches are ON and that all the engine gauges are within their normal operating ranges (green arc). Press-to-test the annunciator light to make sure they all illuminate. Set the altimeter, attitude indicator, directional gyro and clock. Set the mixtures and advance the propeller controls to the forward position. The friction lock on the right side of the control quadrant should be adjusted. Check to make sure the alternate air is OFF. Adjust the cowl flaps and set the wing flaps and trim (stabilator and rudder) tabs as required. The seat backs should be erect and seat belts and harnesses fastened. Fasten the seat belts on the empty seats.

NOTES

If the fixed shoulder harness (non-inertia reel type) is installed, it must be connected to the seat belt and adjusted to allow proper accessibility to all controls, including fuel selectors, flaps, trim, etc., while maintaining adequate restraint for the occupant.

If the inertia reel type shoulder harness is installed, a pull test of its locking restraint feature should be performed.

All controls should be free with full travel, and all doors should be securely latched. Ensure that the auxiliary fuel pumps are OFF. Pitot heat should be used as required. Release the parking brake.

4.33 TAKEOFF

To achieve the takeoff performance specified in Section 5, it is necessary to set rated power (2800 RPM, 40 In. Hg.) prior to brake release.

NOTES

Takeoffs are normally made with less than full throttle - use throttle only as required to obtain 40 in. Hg. manifold pressure. DO NOT EXCEED 40 IN. HG. MANIFOLD PRESSURE.

The "overboost" indicator lights on the annunciator panel will illuminate at approximately 39.8 in. Hg. manifold pressure. Do not exceed 40 in. Hg. manifold pressure.

Illumination of the yellow overboost light on the annunciator panel does not indicate a malfunction. The overboost lights illuminate when manifold pressure approaches the maximum limit. The overboost lights should be monitored during takeoff to ensure that an overboost condition does not persist.

Takeoff should not be attempted with ice or frost on the wings. Takeoff distances and 50-foot obstacle clearance distances are shown on charts in the Performance Section of this handbook. The performance shown on charts will be reduced by uphill gradient, tailwind component, or soft, wet, rough or grassy surface, or poor pilot technique.

Avoid fast turns onto the runway, followed by immediate takeoff, especially with a low fuel supply. Fast taxi turns immediately prior to takeoff run can cause temporary malfunction of one engine on takeoff. As power is applied at the start of the takeoff roll, look at the engine instruments to see that the engines are operating properly and putting out normal power, and at the airspeed indicator to see that it is functioning. Apply throttle smoothly until 40 in. Hg. manifold pressure is obtained. DO NOT APPLY ADDITIONAL THROTTLE.

The flap setting for normal takeoff is 0°. In certain short field takeoff efforts when the shortest possible ground roll and the greatest clearance distance over a 50 ft. obstacle is desired, a flap setting of 25° is recommended.

When obstacle clearance is no problem, a normal flaps up (0°) takeoff may be used. Apply and hold the brakes. Set the flaps to the up (0°) position. Release the brakes, accelerate to 79 KIAS and ease back on the wheel enough to let the airplane lift off and climb past obstacle. After obstacle clearance, accelerate to the best rate of climb speed, 92 KIAS, or higher if desired, retracting the landing gear when a gear-down landing is no longer possible on the runway.

When the shortest possible ground roll and the greatest clearance distance over a 50-foot obstacle is desired, use a 25-degree flap setting (second notch). Set the stabilator trim indicator slightly nose up from the takeoff range. Apply and hold the brakes and bring the engines to full power before release. Release the brakes, accelerate to 64 KIAS and rotate firmly so that when passing through the 50-foot height the airspeed is approximately 66 KIAS. Retract the gear when a gear down landing is no longer possible on the runway.

It should be noted that the airplane is momentarily near V_{MC} when using the above procedure. IN THE EVENT THAT AN ENGINE FAILURE SHOULD OCCUR WHILE THE AIRPLANE IS BELOW V_{MC}, IT IS MANDATORY THAT THE THROTTLE ON THE OPERATING ENGINE BE RETARDED AND THE NOSE LOWERED IMMEDIATELY TO MAINTAIN CONTROL OF THE AIRPLANE. It should also be noted that when a 25-degree flap setting is used on the takeoff roll, an effort to hold the airplane on the runway too long may result in a "wheelbarrowing" tendency. This should be avoided.

The distances required using this takeoff procedure are given on a chart in the Performance Section of this handbook.

4.35 CLIMB

On climb-out after takeoff, it is recommended that the best angle of climb speed (76 KIAS) be maintained only if obstacle clearance is a consideration. The best rate of climb speed (92 KIAS) should be maintained with takeoff power on the engines until adequate terrain clearance is obtained. At this point, engine power should be reduced to approximately 75% power for cruise climb. A cruise climb speed of 102 KIAS or higher is also recommended. This combination of reduced power and increased climb speed provides better engine cooling, less engine wear, reduced fuel consumption, lower cabin noise level, and better forward visibility.

When reducing engine power the throttles should be retarded first, followed by the propeller controls. The mixture controls should remain at full rich during the climb. Cowl flaps should be adjusted to maintain cylinder head and oil temperatures within the normal ranges specified for the engine. During climbs under hot weather conditions, it may be necessary to use LO auxiliary fuel pump for vapor suppression.

Consistent operational use of cruise climb power settings is strongly recommended since this practice will make a substantial contribution to fuel economy and increased engine life, and will reduce the incidence of premature engine overhauls.

4.37 CRUISING

When leveling off at cruise altitude, the pilot may reduce to a cruise power setting in accordance with the Power Setting Table in this handbook.

For 45, 55 and 65% power the mixture should be leaned to 25° rich of peak E.G.T. but not to exceed 1650°F E.G.T. For 75% power the mixture should be leaned to 14.5 G.P.H. but not to exceed 1525°F E.G.T. The mixture should be full rich at powers above 75%.

For maximum engine service life, cylinder head temperatures should be maintained below 420°F and oil temperatures below 200°F during cruise. These temperatures can be maintained by opening the cowl flaps, reducing the power, enriching the mixture or any combination of these methods.

The pilot should monitor weather conditions while flying and should be alert to conditions which might lead to icing. If induction system icing is expected, place the alternate air control in the "ON" position.

WARNING

Flight in icing conditions is prohibited unless aircraft is equipped with the approved and complete Piper ice protection system (see Supplement 6, Section 9). If icing is encountered, immediate action should be taken to fly out of icing conditions. Icing is hazardous due to greatly reduced performance, loss of forward visibility, possible longitudinal control difficulties due to increased control sensitivity, and impaired power plant and fuel system operation.

The ammeters for the electrical system should be monitored during flight, especially during night or instrument flight, so that corrective measures can be taken in case of malfunction. The procedures for dealing with electrical failures are contained in the Emergency Procedure Section of this handbook. The sooner a problem is recognized and corrective action taken, the greater is the chance of avoiding total electrical failure. Both alternator switches should be ON for normal operation. The two ammeters continuously indicate the alternator outputs. Certain regulator failures can cause the alternator output voltage to increase uncontrollably. To prevent damage, overvoltage relays are installed to automatically shut off the alternator(s). The alternator light on the annunciator panel will illuminate to warn of the tripped condition. Alternator outputs will vary with the electrical equipment in use and the state of charge of the battery. Alternator outputs should not exceed 65 amperes.

Should the current requirement exceed 130 amps, the alternators will continue at 65 amps each, the remainder coming from the battery. Therefore, to insure against battery discharge, it is recommended that electrical loads be adjusted to limit continuous alternator outputs to 55 amps. It is not recommended to take off into IFR operation with only one alternator operative even though electrical loads may be less than 55 amps.

Since the Seneca III has one combined fuel tank per engine, it is advisable to feed the engines symmetrically during cruise so that approximately the same amount of fuel will be left in each side for the landing. A crossfeed is provided and can be used in cruise after 30 minutes of flight to balance the fuel quantity and extend the range during single-engine operation. Monitor the fuel quantity for the tank not being used to avoid overflow due to vapor return.

During flight, keep account of time and fuel used in connection with power settings to determine how the fuel flow and fuel quantity gauging systems are operating. If the fuel flow indication is considerably higher than the fuel actually being consumed or if an asymmetric flow gauge indication is observed, a fuel nozzle may be clogged and require cleaning.

There are no mechanical uplocks in the landing gear system. In the event of a hydraulic system malfunction, the landing gear will free-fall to the gear down position. The true airspeed with gear down is approximately 75% of the gear retracted airspeed for any given power setting. Allowances for the reduction in airspeed and range should be made when planning extended flight between remote airfields or flight over water.

For flight above 12,500 feet see FAR 91.32 requirements for oxygen and Section 9 - Supplements in this handbook.

4.39 DESCENT

When power is reduced for descent, the mixtures should be enriched as altitude decreases. The propellers may be left at cruise setting; however if the propeller speed is reduced, it should be done after the throttles have been retarded. Cowl flaps should normally be closed and the E.G.T. should be maintained at approximately 1300°F or higher to keep the engines at the proper operating temperature.

4.41 APPROACH AND LANDING

Sometime during the approach for a landing, the throttle controls should be retarded to check the gear warning horn. Flying the airplane with the horn inoperative is not advisable. Doing so can lead to a gear up landing as it is easy to forget the landing gear, especially when approaching for a single-engine landing, or when other equipment is inoperative, or when attention is drawn to events outside the cabin. The red landing gear unsafe light will illuminate when the landing gear is in transition between the full up position and the down and locked position. Additionally, the light will illuminate when the gear warning horn sounds. The gear warning horn will sound at low throttle settings if the gear is not down and locked.

The light is off when the landing gear is in either the full down and locked or full up positions.

Prior to entering the traffic pattern, the aircraft should be slowed to approximately 120 KIAS, and this speed should be maintained on the downwind leg. The landing check should be made on the downwind leg. The seat backs should be erect, and the seat belts and shoulder harnesses should be fastened.

NOTE

If the fixed shoulder harness (non-inertia reel type) is installed, it must be connected to the seat belt and adjusted to allow proper accessibility to all controls, including fuel selectors, flaps, trim, etc., while maintaining adequate restraint for the occupant.

If the inertia reel type shoulder harness is installed, a pull test of its locking restraint feature should be performed.

Both fuel selectors should be ON, and the cowl flaps should be set as required. The auxiliary fuel pumps should be OFF. Set the mixture and propeller controls. Select landing gear DOWN and check for three green lights on the panel and look for the nose wheel in the nose wheel mirror. The landing gear should be lowered at speeds below 130 KIAS and the flaps at speeds as follows:

10° (first notch) 140 KIAS maximum
25° (second notch) 122 KIAS maximum
40° (third notch) 115 KIAS maximum

Maintain a traffic pattern speed of 100 KIAS and a final approach speed of 90 KIAS. If the aircraft is lightly loaded, the final approach speed may be reduced to 79 KIAS.

When the power is reduced on close final approach, the propeller controls should be advanced to the full forward position to provide maximum power in the event of a go-around.

The landing gear position should be checked on the downwind leg and again on final approach by checking the three green indicator lights on the instrument panel and looking at the external mirror to check that the nose gear is extended. Remember that when the navigation lights are on, the gear position lights are dimmed and are difficult to see in the daytime.

Flap position for landing will depend on runway length and surface wind. Full flaps will reduce stall speed during final approach and will permit contact with the runway at a slower speed. Good pattern management includes a smooth, gradual reduction of power on final approach, with the power fully off before the wheels touch the runway. This gives the gear warning horn a chance to blow if the gear is not locked down. If electric trim is available, it can be used to assist a smooth back pressure during flare out.

Maximum braking after touch-down is achieved by retracting the flaps, applying back pressure to the wheel and applying pressure on the brakes. However, unless extra braking is needed or unless a strong crosswind or gusty air condition exists, it is best to wait until turning off the runway to retract the flaps. This will permit full attention to be given to the landing and landing roll, and will also prevent the pilot from accidentally reaching for the gear handle instead of the flap handle.

For a normal landing, approach with full flaps (40°) and partial power until shortly before touch-down. Hold the nose up as long as possible before and after contacting the ground with the main wheels.

Approach with full flaps at 82 KIAS for a short field landing. immediately after touch-down, raise the flaps, apply back pressure to the wheel and apply brakes.

If a crosswind or high wind landing is necessary, approach with higher than normal speed and with zero to 25 degrees of flaps. Immediately after touch-down, raise the flaps. During a crosswind approach hold a crab angle into the wind until ready to flare out for the landing. Then lower the wing that is into the wind, to eliminate the crab angle without drifting, and use the rudder to keep the wheels aligned with the runway. Avoid prolonged side slips with a low fuel indication.

The maximum demonstrated crosswind component for landing is 17 KTS.

4.43 GO-AROUND

If a go-around from a normal approach with the airplane in the landing configuration becomes necessary, apply takeoff power to both engines (not to exceed 40 in. Hg. manifold pressure). Establish a positive climb attitude, retract the flaps and landing gear and adjust the cowl flaps for adequate engine cooling.

4.45 AFTER LANDING

After leaving the runway, retract the flaps and open the cowl flaps. Test the toe brakes, a spongy pedal is often an indication that the brake fluid needs replenishing. The alternate air control should be OFF.

4.47 SHUTDOWN

Prior to shutdown, switch the heater (if on) to the FAN position a few minutes for cooling and then turn it OFF. All radio and electrical equipment should be turned OFF.

Move the mixture controls to idle cut-off. Turn OFF the magneto and battery switches and set the parking brake.

NOTE

The flaps must be placed in the "UP" position for the flap step to support weight. Passengers should be cautioned accordingly.

4.49 MOORING

The airplane can be moved on the ground with the aid of the optional nose wheel tow bar stowed aft of the fifth and sixth seats. Tie-down ropes may be attached to tie-down rings under each wing and to the tail skid. The ailerons and stabilator should be secured by looping the seat belt through the control wheel and pulling it snug. The rudder need not be secured under normal conditions, as its connection to the nose wheel holds it in position. The flaps are locked when in the fully retracted position.

4.51 TURBULENT AIR OPERATION

In keeping with good operating practice used in all aircraft, it is recommended that when turbulent air is encountered or expected, the airspeed be reduced to maneuvering speed to reduce the structural loads caused by gusts and to allow for inadvertent speed build-ups which may occur as a result of the turbulence or of distractions caused by the conditions. (See Subsection 2.3)

4.53 FLIGHT WITH REAR CABIN AND CARGO DOORS REMOVED

The airplane is approved for flight with the rear cabin and cargo doors removed. Certain limitations must be observed in the operation of this airplane in this configuration.

The maximum speed with doors removed is 129 KIAS. The minimum single engine control speed is 67 KIAS. Smoking is not permitted and all loose articles must be tied down and stowed. The jumper's static lines must be kept free of pilot's controls and control surfaces. Operation is approved for VFR non-icing flight conditions only. It is recommended that all occupants wear parachutes when operating with the rear cabin and cargo doors removed.

All climb and cruise performance will be reduced by approximately five percent when the airplane is operated with the rear cabin and cargo doors removed.

4.55 V_{SSE} - INTENTIONAL ONE ENGINE INOPERATIVE SPEED

V_{SSE} is a speed selected by the aircraft manufacturer as a training aid for pilot's in the handling of multi-engine aircraft. It is the minimum speed for intentionally rendering one engine inoperative in flight. This minimum speed provides the margin the manufacturer recommends for use when intentionally performing engine inoperative maneuvers during training in the particular airplane.

The intentional one engine inoperative speed, V_{SSE}, for the Seneca III is 85 KIAS.

4.57 V_{MCA} MINIMUM SINGLE-ENGINE CONTROL SPEED

V_{MCA} is airspeed below which a twin-engine aircraft cannot be controlled in flight with one engine operating at takeoff power and the other engine windmilling. V_{MCA} for the Seneca III has been determined to be 66 KIAS. Under no circumstances should an attempt be made to fly at a speed below this V_{MCA} with only one engine operating. As a safety precaution, when operating under single-engine flight conditions either in training or in emergency situations, maintain an indicated airspeed above 85 KIAS, V_{SSE}.

The V_{MCA} demonstration required for the FAA flight test for the multi-engine rating approaches an uncontrolled flight condition with power reduced on one engine. The demonstration should not be performed at an altitude of less than 3500 feet above the ground. Initiate recovery during the demonstration by immediately reducing power on the operating engine and promptly lowering the nose of the airplane to accelerate to V_{SSE}.

The most critical situation occurs where the stall speed and V_{MCA} speed coincide. Care should be taken to avoid this flight condition, because at this point loss of directional control occurs at the same time the airplane stalls, and a spin could result.

V_{MCA} DEMONSTRATION

(a) Landing Gear	UP
(b) Flaps	UP
(c) Airspeed	at or above 85 KIAS (V_{SSE})
(d) Propeller Controls	HIGH RPM
(e) Throttle (Simulated Inoperative Engine)	IDLE
(f) Throttle (Other Engine)	MAX ALLOWABLE
(g) Airspeed	Reduce approximately 1 knot per second until either V_{MCA} or STALL WARNING is obtained

CAUTIONS

Use rudder to maintain directional control (heading) and ailerons to maintain 5° bank towards the operative engine (lateral attitude). At the first sign of either V_{MCA} or stall warning (which may be evidenced by an inability to maintain heading or lateral attitude, aerodynamic stall buffet, or stall warning horn) immediately initiate recovery, reduce power to idle on the operative engine, and immediately lower the nose to regain V_{SSE}.

One engine inoperative stalls are not recommended.

Under no circumstances should an attempt be made to fly at a speed below V_{MCA} with only one engine operating.

4.59 STALLS

The loss of altitude during a power off stall with the gear and flaps retracted may be as much as 400 feet. The loss of altitude with the gear down and 40° of flaps may also be as much as 400 feet.

A power on stall may result in as much as 150 feet of altitude loss.

The stall warning system is inoperative with the battery switch OFF.

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SECTION 5

PERFORMANCE

SECTION 5

PERFORMANCE

5.1 GENERAL

This section contains the required FAA performance information applicable to this aircraft. Additional information is provided for flight planning purposes.

Performance information associated with those optional systems and equipment which require handbook supplements is provided by Section 9 (Supplements).

5.3 INTRODUCTION - PERFORMANCE AND FLIGHT PLANNING

The performance information presented in this section is based on measured Flight Test Data corrected to I.C.A.O. standard day conditions and analytically expanded for the various parameters of weight, altitude, temperature, etc.

The performance charts are unfactored and do not make any allowance for varying degrees of pilot proficiency or mechanical deterioration of the aircraft. This performance, however, can be duplicated by following the stated procedures in a properly maintained airplane.

Effects of conditions not considered on the charts must be evaluated by the pilot, such as the effect of soft or grass runway surface on takeoff and landing performance, or the effect of winds aloft on cruise and range performance. Endurance can be grossly affected by improper leaning procedures, and inflight fuel flow and quantity checks are recommended.

REMEMBER! To get chart performance, follow the chart procedures.

The information provided by paragraph 5.5 (Flight Planning Example) outlines a detailed flight plan using the performance charts in this section. Each chart includes its own example to show how it is used.

WARNING

Performance information derived by extrapolation beyond the limits shown on the charts should not be used for flight planning purposes.

5.5 FLIGHT PLANNING EXAMPLE

(a) Aircraft Loading

The first step in planning the flight is to calculate the airplane weight and center of gravity by utilizing the information provided by Section 6 (Weight and Balance) of this handbook.

The basic empty weight for the airplane as licensed at the factory has been entered in Figure 6-5. If any alterations to the airplane have been made effecting weight and balance, reference to the aircraft logbook and Weight and Balance Record (Figure 6-7) should be made to determine the current basic empty weight of the airplane.

Make use of the Weight and Balance Loading Form (Figure 6-11) and C.G. Range and Weight graph (Figure 6-15) to determine the total weight of the airplane and the center of gravity position.

The landing weight cannot be determined until the weight of the fuel to be used has been established [refer to item (g)(1)].

(1)	Basic Empty Weight	3122 lbs.
(2)	Occupants (2 x 170 lbs.)	340 lbs.
(3)	Baggage and Cargo	27 lbs.
(4)	Fuel (6 lb./gal. x 80)	480 lbs.
(5)	Takeoff Weight	3969 lbs.
(6)	Landing Weight (a)(5) minus (g)(1), (3969 lbs. minus 314 lbs.)	3655 lbs.

The takeoff and landing weights are below the maximums and the weight and balance calculations have determined that the C.G. position is within the approved limits.

(b) Takeoff and Landing

Apply the departure airport conditions and takeoff weight to the appropriate Takeoff Performance and Accelerate and Stop Distance graphs (Figures 5-7 thru 5-15) to determine the length of runway necessary for the takeoff and/or the barrier distance.

The landing distance calculations are performed in the same manner using the existing conditions at the destination airport and, when established, the landing weight.

The conditions and calculations for the example flight are listed below. The takeoff and landing distances required for the example flight have fallen well below the available runway lengths.

	Departure Airport	Destination Airport
(1) Pressure Altitude	2000 ft.	3000 ft.
(2) Temperature	21°C	22°C
(3) Wind Component	9 KTS (Headwind)	10 KTS (Headwind)
(4) Runway Length Available	7400 ft.	9000 ft.
(5) Runway Required (Normal Procedure, Std. Brakes)		
Takeoff	1650 ft.*	
Accelerate and Stop	3260 ft.**	
Landing		2260 ft.***

NOTE

The remainder of the performance charts used in this flight plan example assume a no wind condition. The effect of winds aloft must be considered by the pilot when computing climb, cruise and descent performance.

(c) Climb

The desired cruise pressure altitude and corresponding cruise outside air temperature values are the first variables to be considered in determining the climb components from the Fuel, Time and Distance to Climb graph (Figure 5-23). After the fuel, time and distance for the cruise pressure altitude and outside air temperature values have been established, apply the existing conditions at the departure field to the graph (Figure 5-23). Now, subtract the values obtained from the graph for the field of departure conditions from those for the cruise pressure altitude.

*reference Figure 5-7
**reference Figure 5-13
***reference Figure 5-39

The remaining values are the true fuel, time and distance components for the climb segment of the flight plan corrected for field pressure altitude and temperature.

The following values were determined from the above instructions in the flight planning example.

(1)	Cruise Pressure Altitude	16,500 ft.
(2)	Cruise OAT	-13°C
(3)	Time to Climb (15 min. minus 2 min.)	13 min.*
(4)	Distance to Climb (27 naut. miles minus 3 naut. miles)	24 naut. miles*
(5)	Fuel to Climb (12 gal. minus 1 gal.)	11 gal.*

(d) Descent

The descent data will be determined prior to the cruise data to provide the descent distance for establishing the total cruise distance.

Utilizing the cruise pressure altitude and OAT, determine the basic fuel, time and distance for descent (Figure 5-37). These figures must be adjusted for the field pressure altitude and temperature at the destination airport. To find the necessary adjustment values, use the existing pressure altitude and temperature conditions at the destination airport as variables to find the fuel, time and distance values from the graph (Figure 5-37). Now, subtract the values obtained from the field conditions from the values obtained from the cruise conditions to find the true fuel, time and distance values needed for the flight plan.

The values obtained by proper utilization of the graphs for the descent segment of the example are shown below.

(1)	Time to Descend (16 min. minus 3 min.)	13 min.**
(2)	Distance to Descend (44 naut. miles minus 7 naut. miles)	37 naut. miles**
(3)	Fuel to Descend (6 gal. minus 1 gal.)	5 gal.**

*reference Figure 5-23
**reference Figure 5-37

(e) Cruise

Using the total distance to be traveled during the flight, subtract the previously calculated distance to climb and distance to descend to establish the total cruise distance. Refer to the Power Setting Tables when selecting the cruise power setting. The established pressure altitude and temperature values and the selected cruise power should now be utilized to determine the true airspeed from the Speed Power graph (Figure 5-27).

Calculate the cruise fuel for the cruise power setting from the information provided on Figure 5-25.

The cruise time is found by dividing the cruise distance by the cruise speed and the cruise fuel is found by multiplying the cruise fuel flow by the cruise time.

The cruise calculations established for the cruise segment of the flight planning example are as follows:

(1) Total Distance	394 miles
(2) Cruise Distance (e)(1) minus (c)(4) minus (d)(2), (394 naut. miles minus 24 naut. miles minus 37 naut. miles)	333 naut. miles
(3) Cruise Power	55% rated power
(4) Cruise Speed	172 KTS TAS*
(5) Cruise Fuel Consumption	18.7 GPH**
(6) Cruise Time (e)(2) divided by (e)(4), (333 naut. miles divided by 172 KTS)	1.94 hrs.
(7) Cruise Fuel (e)(5) multiplied by (e)(6), (18.7 GPH multiplied by 1.94 hrs.)	36.3 gal.

*reference Figure 5-27
**reference Figure 5-25

(f) Total Flight Time

The total flight time is determined by adding the time to climb, the time to descend and the cruise time. Remember! The time values taken from the climb and descent graphs are in minutes and must be converted to hours before adding them to the cruise time.

The following flight time is required for the flight planning example.

(1) Total Flight Time

(c)(3) plus (d)(1) plus (e)(6),	
(0.22 hrs. plus 0.22 hrs. plus 1.94 hrs.)	2.38 hrs.

(g) Total Fuel Required

Determine the total fuel required by adding the fuel to climb, the fuel to descend and the cruise fuel. When the total fuel (in gallons) is determined, multiply this value by 6 lb./gal. to determine the total fuel weight used for the flight.

The total fuel calculations for the example flight plan are shown below.

(1) Total Fuel Required

(c)(5) plus (d)(3) plus (e)(7),	
(11 gal. plus 5 gal. plus 36.3 gal.)	52.3 gal.
(52.3 gal. multiplied by 6 lb./gal.)	313.8 lbs.

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5.7 PERFORMANCE GRAPHS

LIST OF FIGURES

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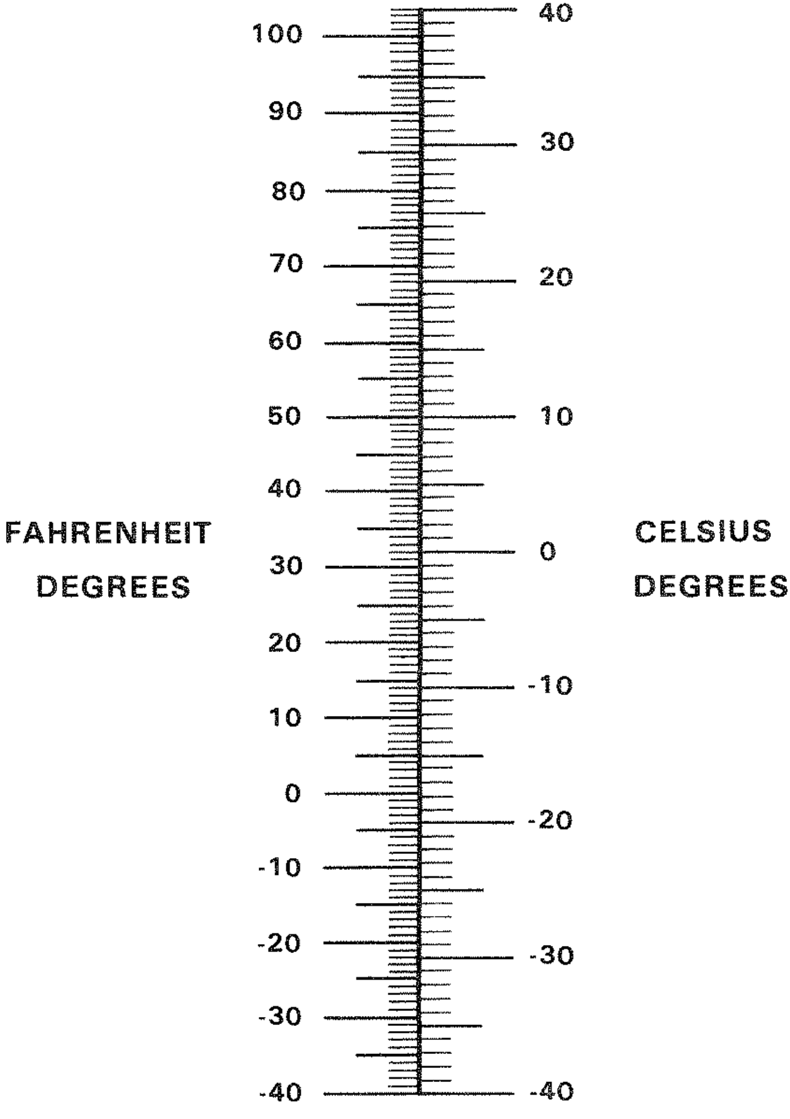
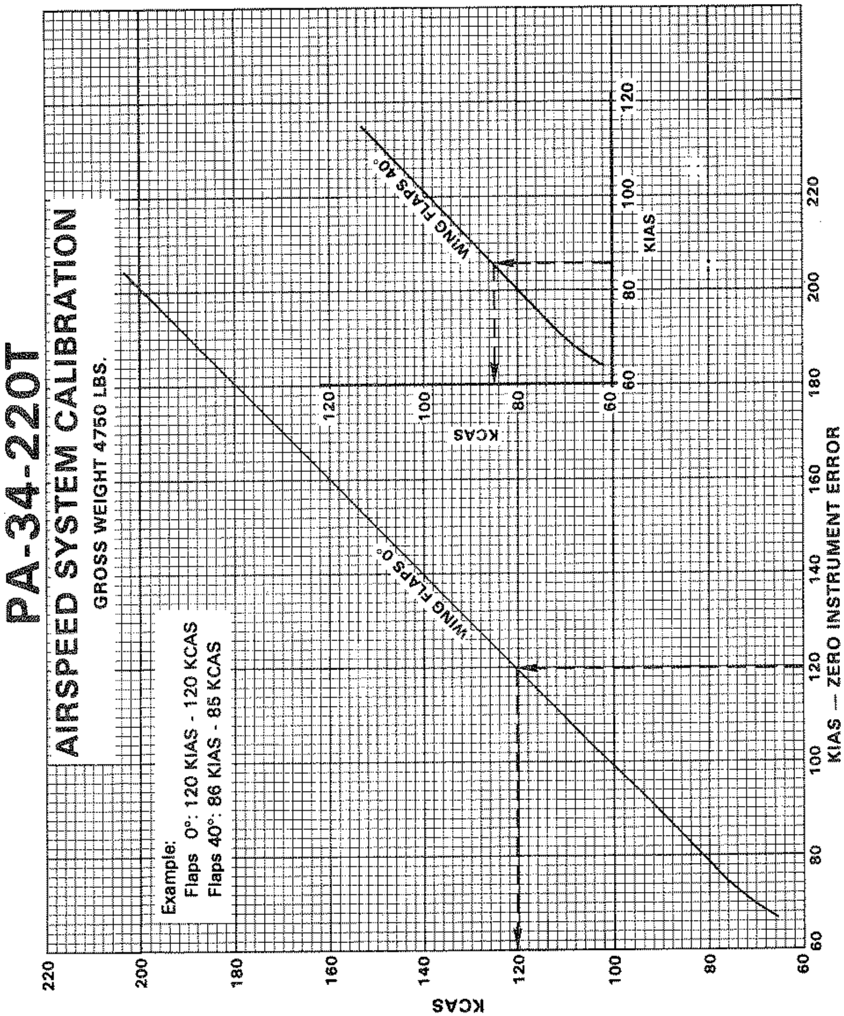
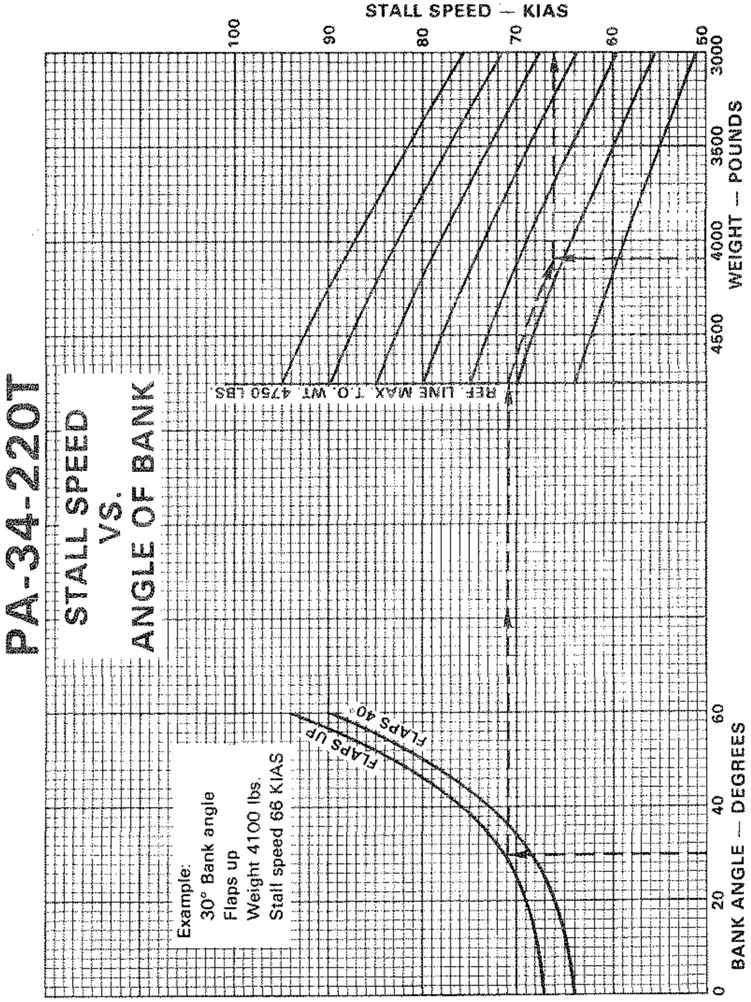


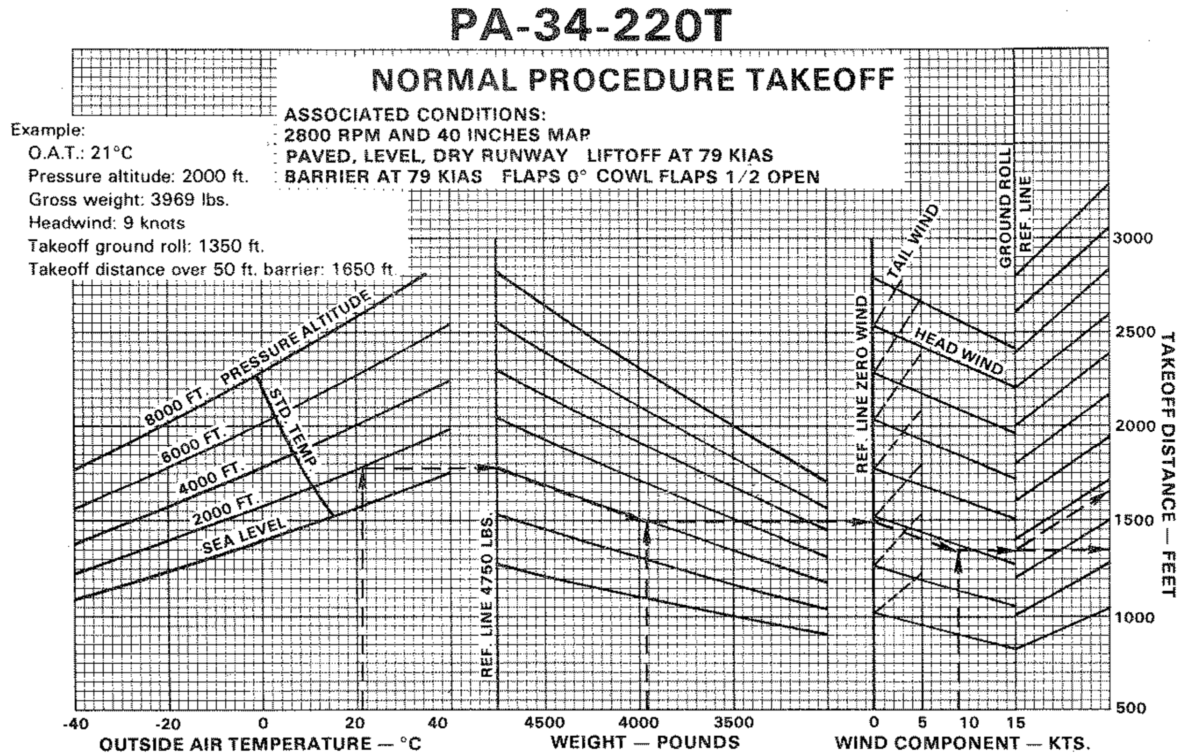
TEMPERATURE CONVERSION CHART
Figure 5-1



AIRSPEED SYSTEM CALIBRATION
Figure 5-3



STALL SPEED VS. ANGLE OF BANK
Figure 5-5



NORMAL PROCEDURE TAKEOFF
Figure 5-7

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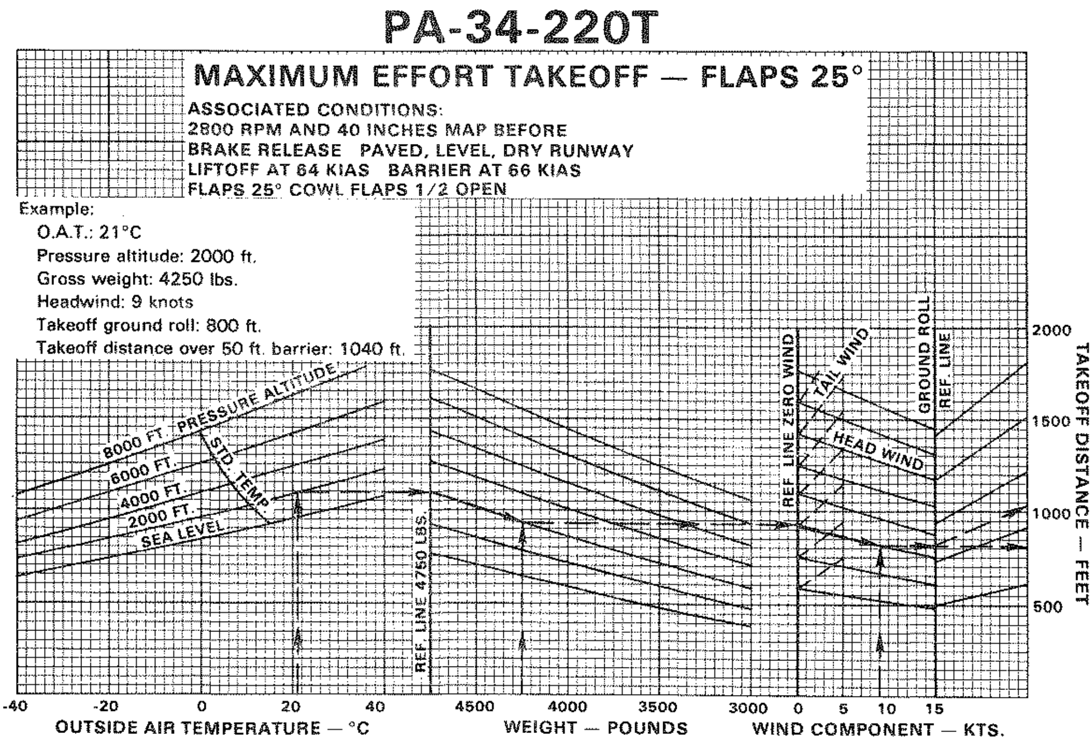
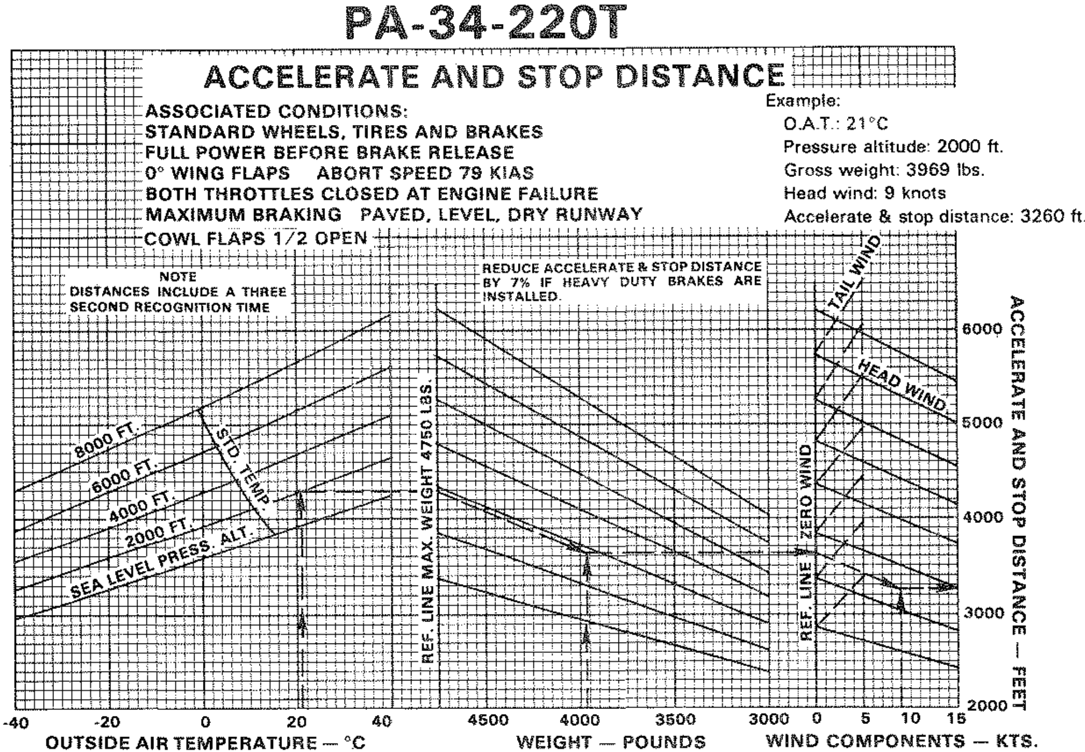
Figure 5-9

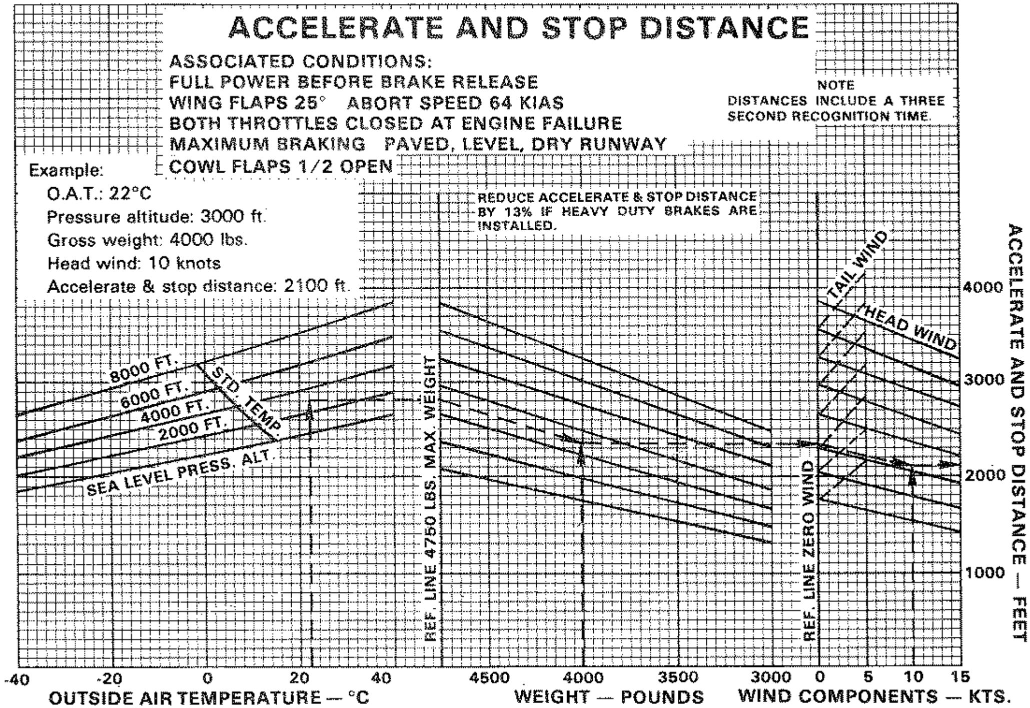


MAXIMUM EFFORT TAKEOFF - 25° FLAPS
Figure 5-11

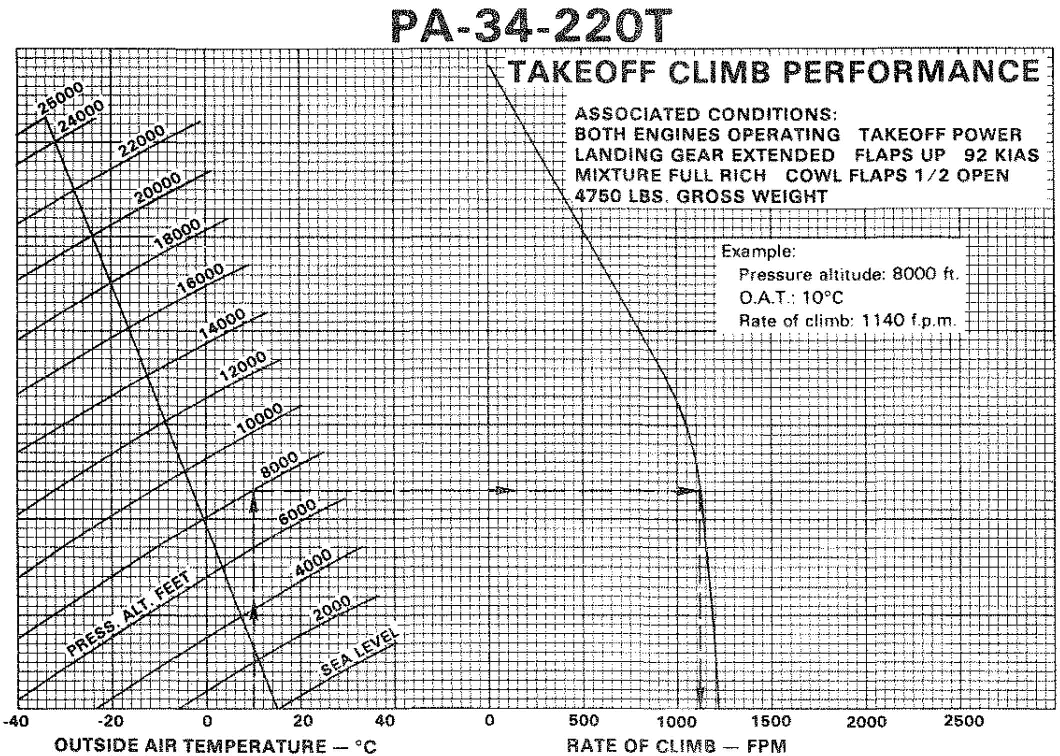


ACCELERATE AND STOP DISTANCE - 0° FLAPS
Figure 5-13

PA-34-220T

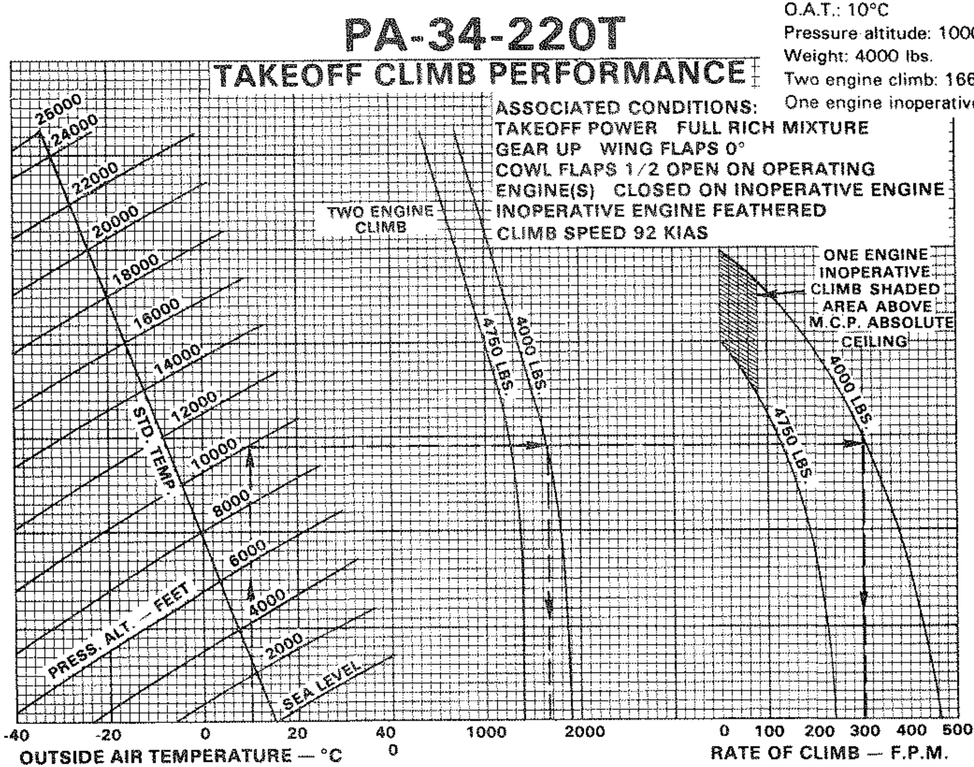


ACCELERATE AND STOP DISTANCE - 25° FLAPS
Figure 5-15

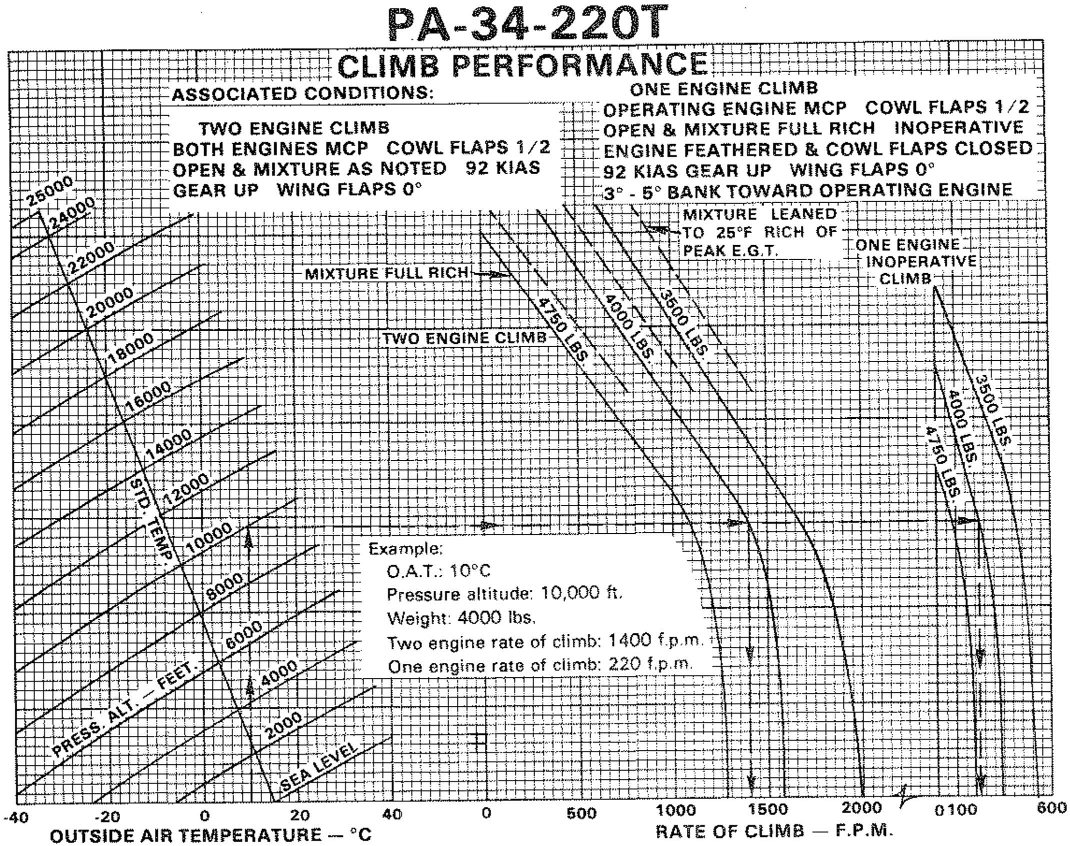


TAKEOFF CLIMB PERFORMANCE - GEAR EXTENDED
Figure 5-17

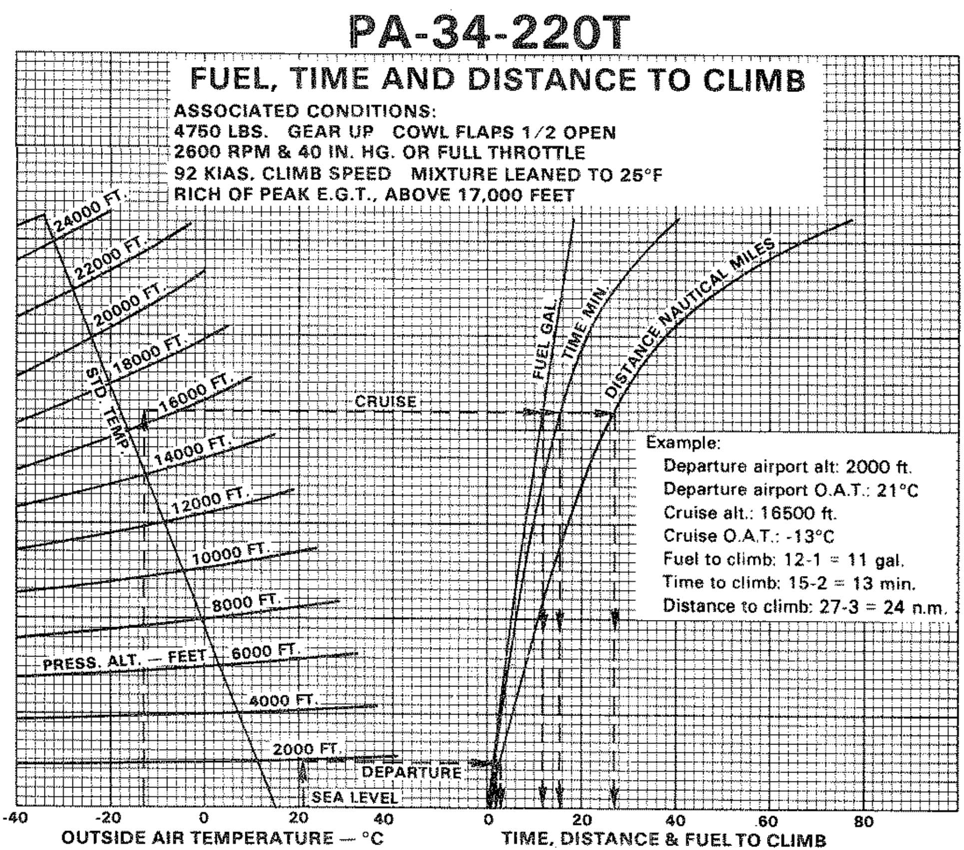
Example:
O.A.T.: 10°C
Pressure altitude: 10000 ft.
Weight: 4000 lbs.
Two engine climb: 1660 f.p.m.
One engine inoperative climb: 300 f.p.m.



TAKEOFF CLIMB PERFORMANCE - GEAR RETRACTED
Figure 5-19



CLIMB PERFORMANCE - GEAR RETRACTED - MAXIMUM CONTINUOUS POWER
Figure 5-21



FUEL, TIME AND DISTANCE TO CLIMB
Figure 5-23

POWER SETTING TABLE - T.C.M. TSIO-360K SERIES PA-34-220T

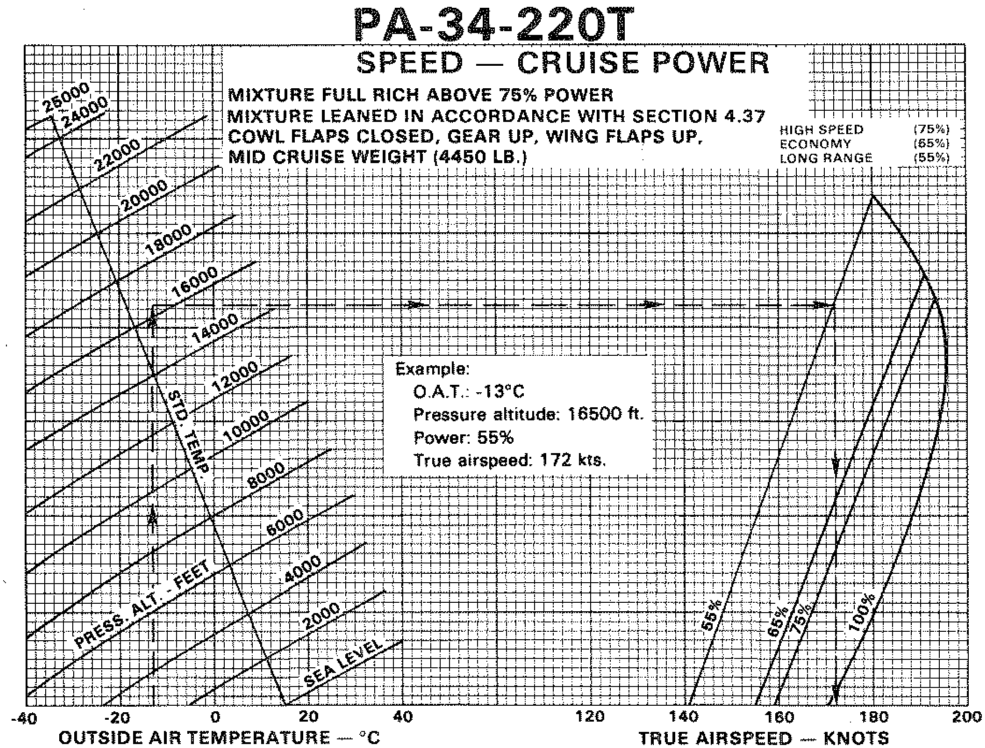
Press. Alt. Feet	Std. Alt. Temp. °C	45% Power Approx. Fuel 16 G.P.H. RPM AND MAN. PRESS.						55% Power Approx. Fuel 18.7 G.P.H. RPM AND MAN. PRESS.						65% Power Approx. Fuel 23.3 G.P.H. RPM AND MAN. PRESS.			75% Power Approx. Fuel 29.0 G.P.H. RPM AND MAN. PRESS.	
		2100	2200	2300	2400	2500	2600	2100	2200	2300	2400	2500	2600	2400	2500	2600	2500	2600
S.L.	15	27.1	26.4	25.5	24.3	23.3	22.5	31.2	30.3	29.4	28.2	27.2	26.3	33.8	32.0	31.0	34.0	33.0
2000	11	26.4	25.8	24.6	23.7	22.8	22.1	30.5	29.7	28.8	27.8	26.8	26.0	33.2	31.7	30.7	33.8	32.7
4000	7	25.8	25.0	24.0	23.2	22.3	21.8	30.0	29.2	28.3	27.4	26.4	25.6	32.8	31.5	30.5	33.6	32.4
6000	3	25.3	24.5	23.5	22.8	21.9	21.5	29.7	28.8	28.0	27.0	26.2	25.3	32.5	31.2	30.3	33.4	32.2
8000	-1	24.8	24.0	23.0	22.4	21.6	21.2	29.4	28.4	27.7	26.8	25.7	25.0	32.3	31.0	30.1	33.1	32.0
10000	-5	24.4	23.7	22.8	22.0	21.4	21.0		28.3	27.5	26.5	25.5	24.7	32.0	30.9	30.0	33.0	31.9
12000	-9	24.0	23.3	22.5	21.7	21.2	20.9		28.3	27.2	26.3	25.3	24.6	31.8	30.7	29.8	32.5	31.8
14000	-13		23.0	22.3	21.4	21.1	20.8			27.1	26.1	25.2	24.4		30.5	29.7		31.7
16000	-17			22.0	21.3	21.0	20.6				25.9	25.0	24.3		30.4	29.5		31.6
18000	-21				21.2	20.9	20.5					25.0	24.2			29.4		
20000	-25				21.2	20.8	20.4						24.2			29.3		
22000	-28						20.4						24.1					
24000	-33						20.4											
25000	-34						20.4											

1650°F MAX E.G.T. (See P.O.H. Section 4)

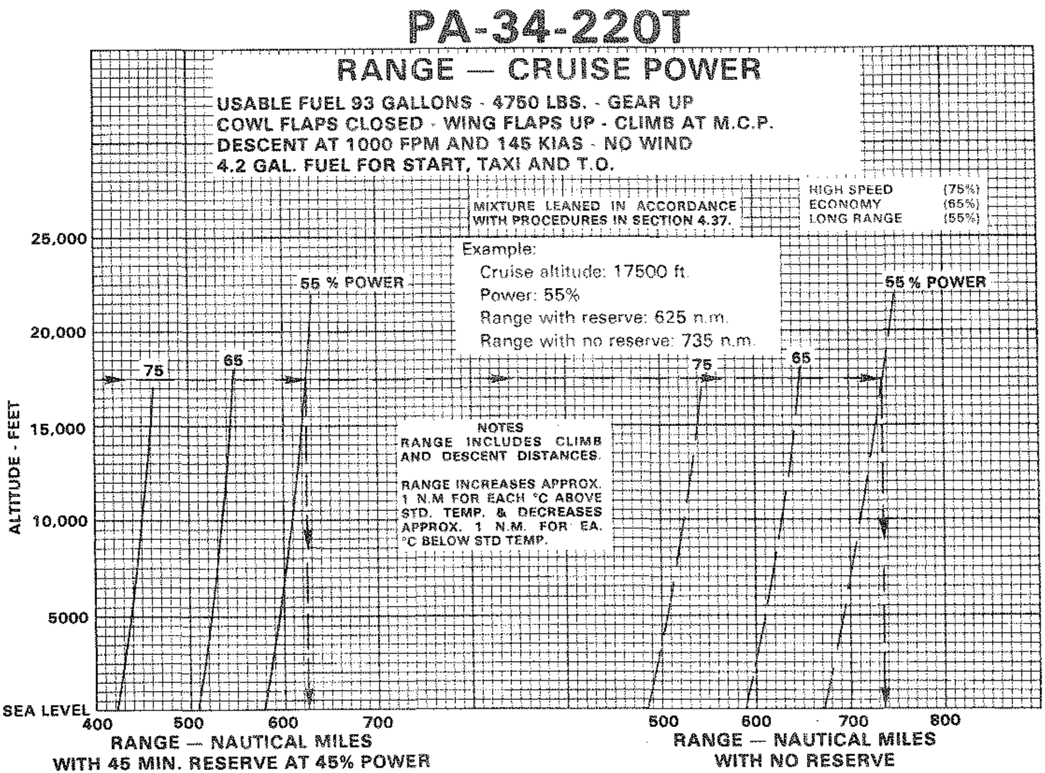
1525°F MAX E.G.T. (See P.O.H. Section 4)

To maintain constant power add approximately 1% for each 6°C above standard. Subtract approximately 1% for each 6°C below standard. Do not exceed 34" MAP in cruise.

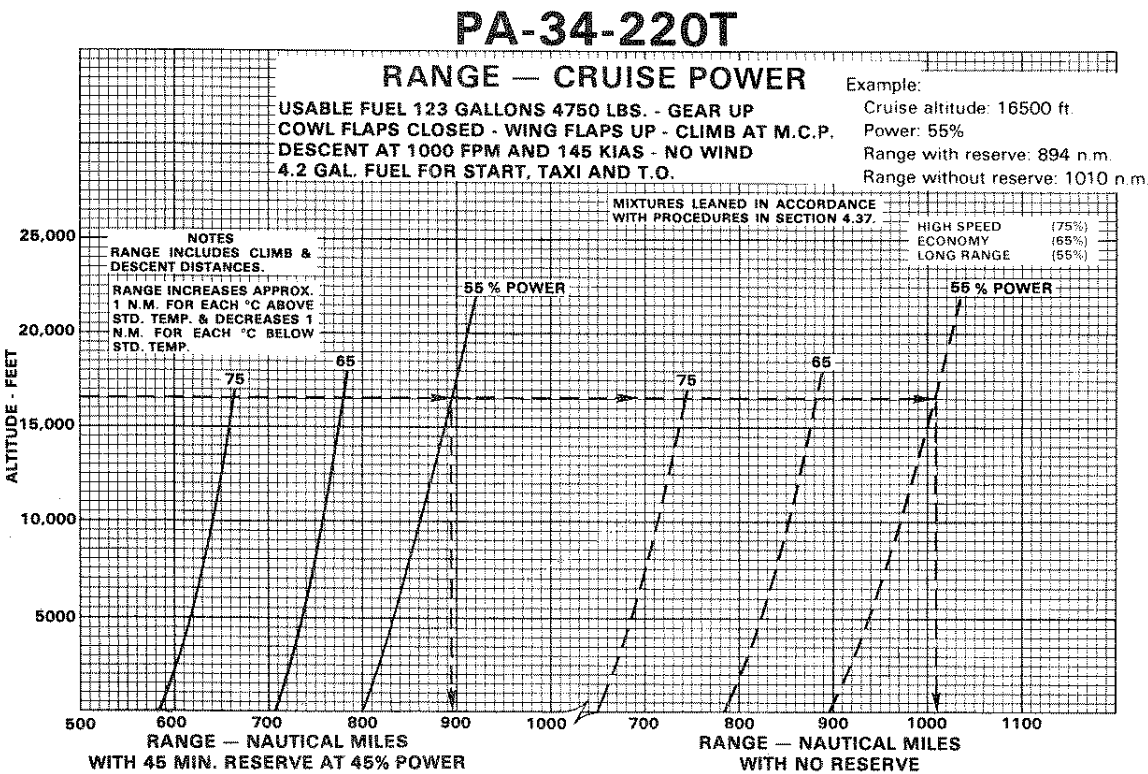
POWER SETTING TABLE
Figure 5-25



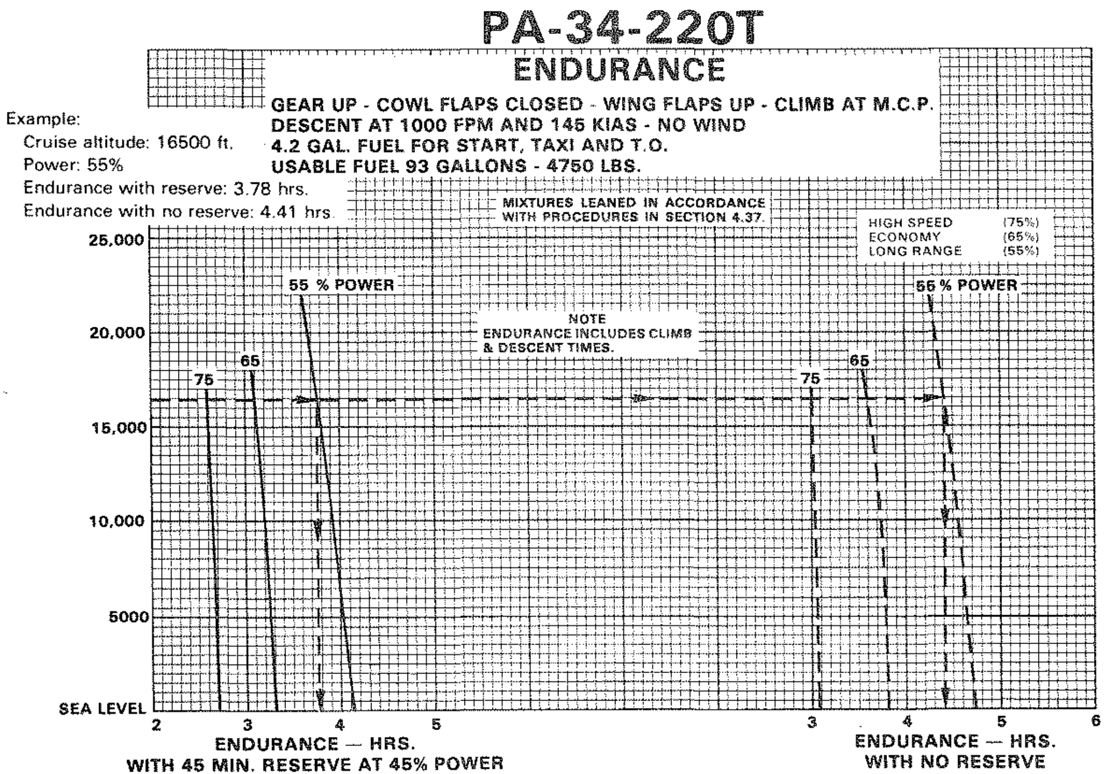
SPEED - CRUISE POWER
Figure 5-27



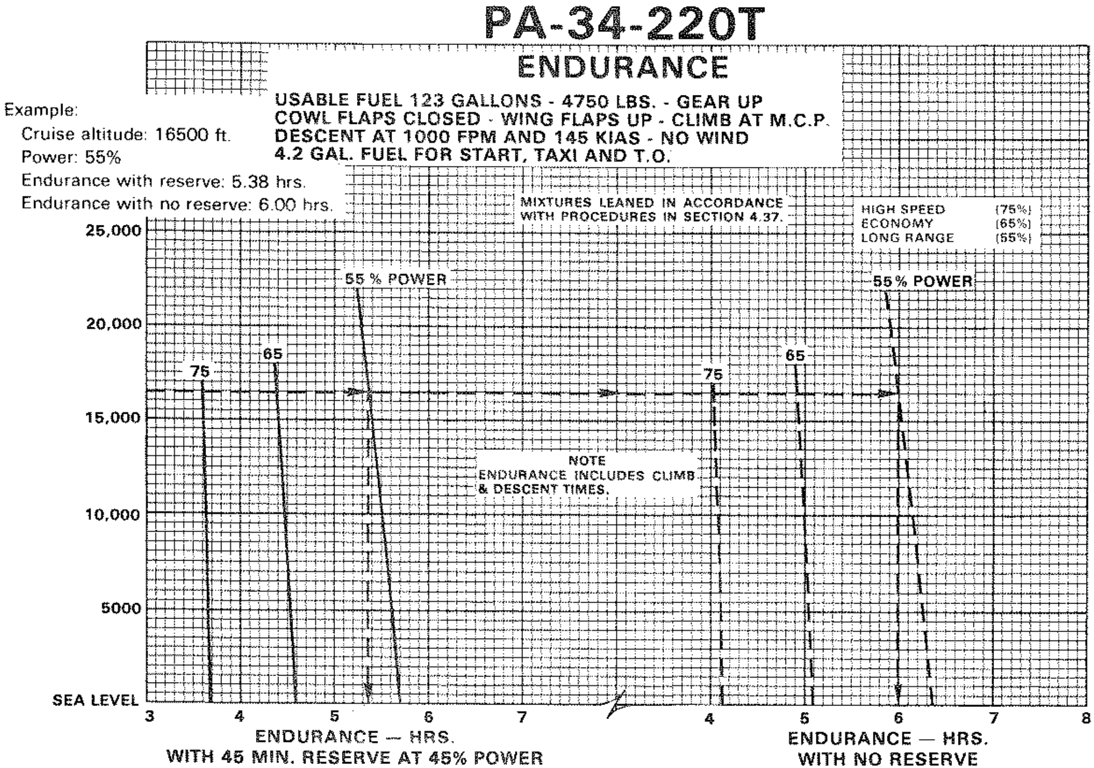
RANGE - CRUISE POWER - 93 GALLONS USABLE
Figure 5-29



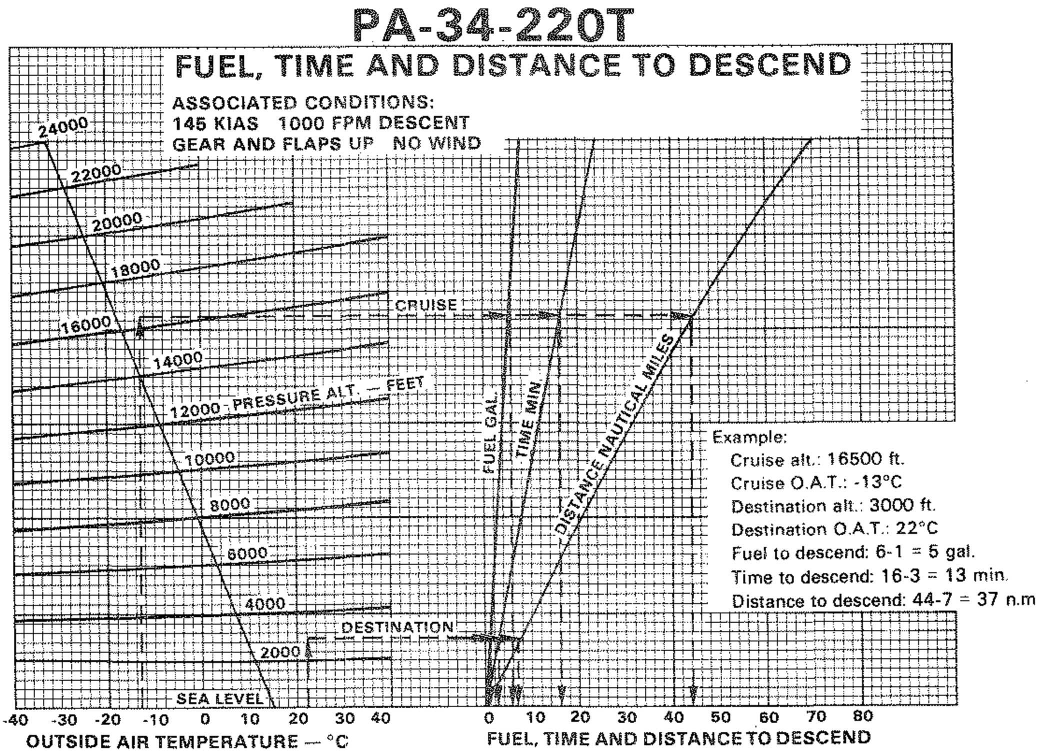
RANGE - CRUISE POWER - 123 GALLONS USABLE
Figure 5-31



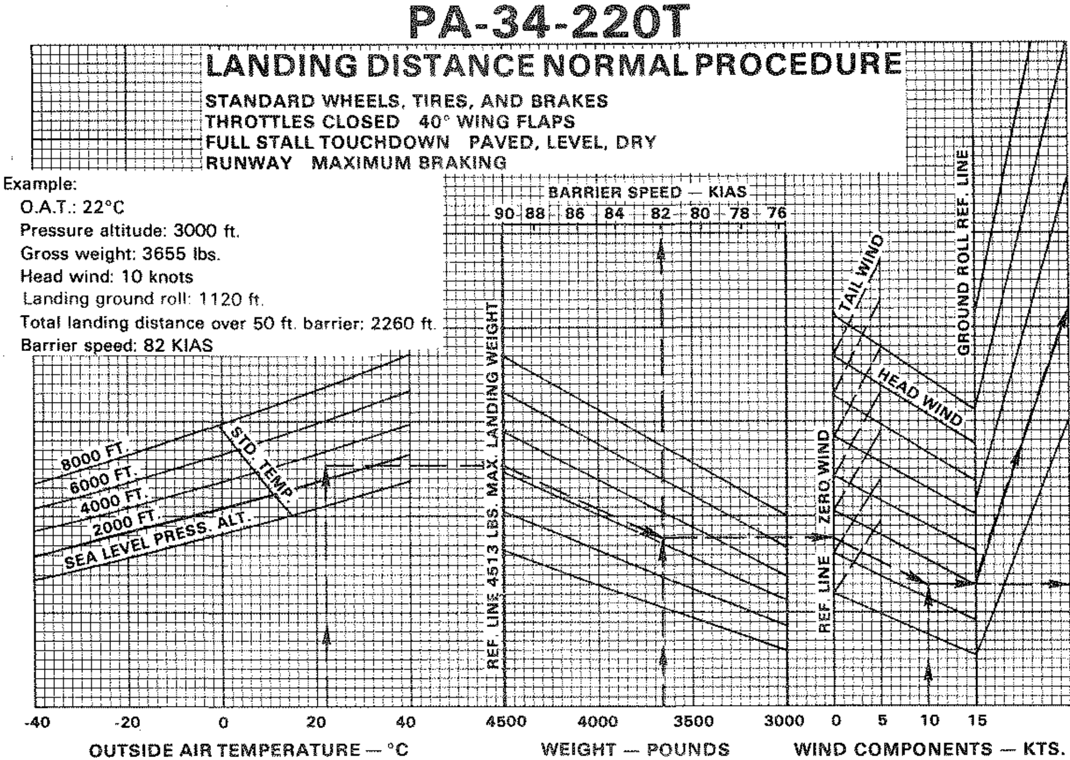
ENDURANCE - 93 GALLONS USABLE
Figure 5-33



ENDURANCE - 123 GALLONS USABLE
Figure 5-35

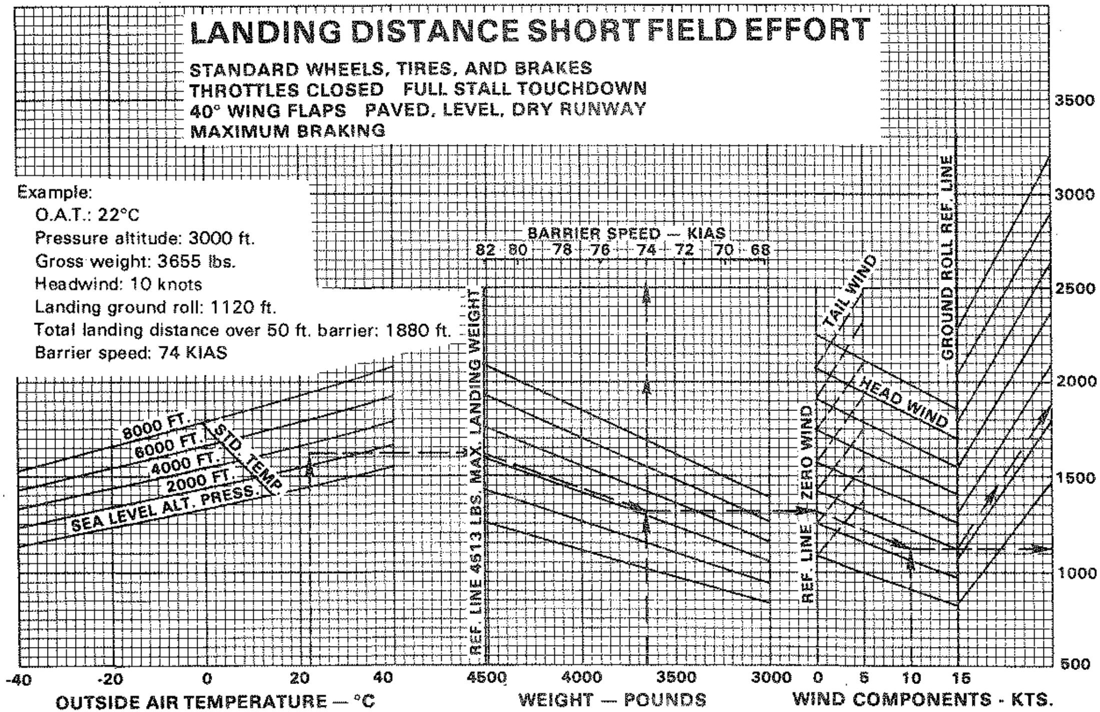


FUEL, TIME AND DISTANCE TO DESCEND
Figure 5-37



LANDING DISTANCE - NORMAL PROCEDURE
Figure 5-39

PA-34-220T



LANDING DISTANCE - SHORT FIELD EFFORT
Figure 5-41

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SECTION 6

WEIGHT AND BALANCE

*For 1982 and preceding models only.
**For 1983 and subsequent models only.

SECTION 6

WEIGHT AND BALANCE

6.1 GENERAL

In order to achieve the performance and flying characteristics which are designed into the airplane, it must be flown with the weight and center of gravity (C.G.) position within the approved operating range (envelope). Although the airplane offers flexibility of loading it cannot be flown with the maximum number of adult passengers, full fuel tanks and maximum baggage. With the flexibility comes responsibility. The pilot must insure that the airplane is loaded within the loading envelope before a takeoff.

Misloading carries consequences for any aircraft. An overloaded airplane will not take off, climb or cruise as well as a properly loaded one. The heavier the airplane is loaded, the less climb performance it will have.

Center of gravity is a determining factor in flight characteristics. If the C.G. is too far forward in any airplane, it may be difficult to rotate for takeoff or landing. If the C.G. is too far aft, the airplane may rotate prematurely on takeoff or tend to pitch up during climb. Longitudinal stability will be reduced. This can lead to inadvertent stalls and even spins; and spin recovery becomes more difficult as the center of gravity moves aft of the approved limit.

A properly loaded airplane, however, will perform as intended. Before the airplane is licensed, it is weighed, and a basic empty weight and C.G. location is computed (basic empty weight consists of the standard empty weight of the airplane plus the optional equipment). Using the basic empty weight and C.G. location, the pilot can easily determine the weight and C.G. position for the loaded airplane by computing the total weight and moment and then determining whether they are within the approved envelope.

The basic empty weight and C.G. location are recorded in the Weight and Balance Data Form (Figure 6-5) and the Weight and Balance Record (Figure 6-7). The current values should always be used. Whenever new equipment is added or any modification work is done, the mechanic responsible for the work is required to compute a new basic empty weight and C.G. position and to write these in the Aircraft Log Book and the Weight and Balance Record. The owner should make sure that it is done.

A weight and balance calculation is necessary in determining how much fuel or baggage can be boarded so as to keep the C.G. within allowable limits. Check calculations prior to adding fuel to insure against improper loading.

The following pages are forms used in weighing an airplane in production and in computing basic empty weight, C.G. position, and useful load. Note that the useful load includes usable fuel, baggage, cargo and passengers. Following this is the method for computing takeoff weight and C.G.

6.3 AIRPLANE WEIGHING PROCEDURES

At the time of licensing, Piper Aircraft Corporation provides each airplane with the basic empty weight and center of gravity location. This data is supplied by Figure 6-5.

The removal or addition of equipment or airplane modifications can affect the basic empty weight and center of gravity. The following is a weighing procedure to determine this basic empty weight and center of gravity location:

(a) Preparation

(1) Be certain that all items checked in the airplane equipment list are installed in the proper location in the airplane.

(2) Remove excessive dirt, grease, moisture, foreign items such as rags and tools from the airplane before weighing.

(3) Defuel airplane. Then open all fuel drains until all remaining fuel is drained. Operate each engine until all undrainable fuel is used and engine stops. Then add the unusable fuel (5.0 gallons total, 2.5 gallons each wing).

(4) Fill with oil to full capacity.

(5) Place pilot and copilot seats in fourth (4th) notch, aft of forward position. Put flaps in the fully retracted position and all control surfaces in the neutral position. Tow bar should be in the proper location and all entrance and baggage doors closed.

(6) Weigh the airplane inside a closed building to prevent errors in scale readings due to wind.

(b) Leveling

(1) With airplane on scales, block main gear oleo pistons in the fully extended position.

(2) Level airplane (refer to Figure 6-3) deflating nose wheel tire, to center bubble on level.

(c) Weighing - Airplane Basic Empty Weight

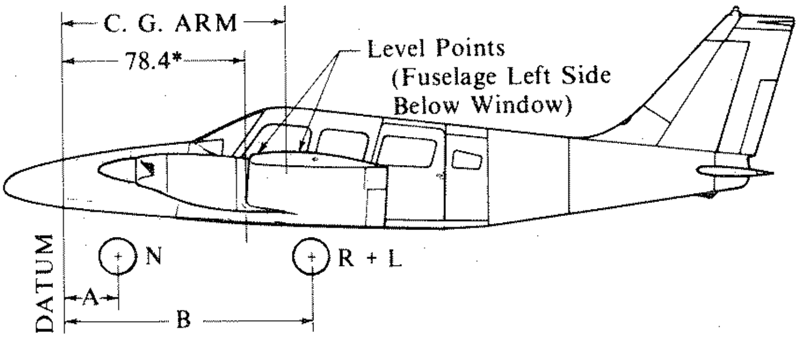
(1) With the airpalne level and the brakes released, record the weight shown on each scale. Deduct the tare, if any, from each reading.

Scale Position and Symbol	Scale Reading	Tare	Net Weight
Nose Wheel	(N)		
Right Main Wheel	(R)		
Left Main Wheel	(L)		
Basic Empty Weight, as Weighed	(T)		

WEIGHING FORM
Figure 6-1

(d) Basic Empty Weight Center of Gravity

(1) The following geometry applies to the PA-34-220T airplane when it is level. Refer to Leveling paragraph 6.3 (b).



A = 25.3
B = 109.8

*The datum is 78.4 inches ahead of the wing leading edge at the inboard edge of the inboard fuel tank.

LEVELING DIAGRAM
Figure 6-3

(2) The basic empty weight center of gravity (as weighed including optional equipment, full oil and unusable fuel) can be determined by the following formula:

$$\text{C.G. Arm} = \frac{N\ (A) + (R + L)\ (B)}{T} \quad \text{inches}$$

Where: T = N + R + L

6.5 WEIGHT AND BALANCE DATA AND RECORD

The Basic Empty Weight, Center of Gravity Location and Useful Load listed in Figure 6-5 are for the airplane as licensed at the factory. These figures apply only to the specific airplane serial number and registration number shown.

The basic empty weight of the airplane as licensed at the factory has been entered in the Weight and Balance Record (Figure 6-7). This form is provided to present the current status of the airplane basic empty weight and a complete history of previous modifications. Any change to the permanently installed equipment or modification which affects weight or moment must be entered in the Weight and Balance Record.

MODEL PA-34-220T SENECA III

Airplane Serial Number ____________________

Registration Number ____________________

Date ____________________

AIRPLANE BASIC EMPTY WEIGHT

Item		Weight (Lbs.)	x C.G. Arm (Inches Aft of Datum)	= Moment (In-Lbs.)
Standard Empty Weight*	Actual Computed			
Optional Equipment				
Basic Empty Weight				

*The standard empty weight includes full oil capacity and 5.0 gallons of unusable fuel.

AIRPLANE USEFUL LOAD - NORMAL CATEGORY OPERATION

(Ramp Weight)** - (Basic Empty Weight) = Useful Load

(4773 lbs.) - (lbs.) =   lbs.

THIS BASIC EMPTY WEIGHT, C.G. AND USEFUL LOAD ARE FOR THE AIRPLANE AS LICENSED AT THE FACTORY. REFER TO THE APPROPRIATE AIRCRAFT RECORD WHEN ALTERATIONS HAVE BEEN MADE.

**Includes fuel allowances for start-up, taxi and run-up (23 lbs.)

WEIGHT AND BALANCE DATA FORM
Figure 6-5

PA-34-220T	Serial Number			Registration Number			Page Number	
Date	Item No.	Description of Article or Modification	Added (+) Removed (-)	Weight Change			Running Basic Empty Weight	
				Wt. (Lb.)	Arm (In.)	Moment 100	Wt. (Lb.)	Moment 100
		As licensed.						

WEIGHT AND BALANCE RECORD
Figure 6-7

PA-34-220T	Serial Number		Registration Number				Page Number	
Date	Item No.	Description of Article or Modification	Added (+) / Removed (-)	Weight Change			Running Basic Empty Weight	
				Wt. (Lb.)	Arm (In.)	Moment 100	Wt. (Lb.)	Moment 100

WEIGHT AND BALANCE RECORD (cont)
Figure 6-7 (cont)

6.7 GENERAL LOADING RECOMMENDATIONS

The following general loading recommendation is intended only as a guide. The charts, graphs, instructions and plotter should be checked to assure the airplane is within the allowable weight vs. center of gravity envelope.

(a) Pilot Only
Load rear baggage compartment to capacity first. Without aft baggage, fuel load may be limited by forward envelope for some combinations of optional equipment.

(b) 2 Occupants - Pilot and Passenger in Front
Load rear baggage compartment to capacity first. Without aft baggage, fuel load may be limited by forward envelope for some combinations of optional equipment.

(c) 3 Occupants - 2 in front, 1 in middle
Load rear baggage compartment to capacity first. Baggage in nose may be limited by forward envelope. Without aft baggage, fuel may be limited by forward envelope for some combinations of optional equipment.

(d) 4 Occupants - 2 in front, 2 in middle
Load rear baggage compartment to capacity first. Baggage in nose may be limited by forward envelope. Without aft baggage, fuel may be limited by forward envelope for some combinations of optional equipment.

(e) 5 Occupants - 2 in front, 2 in middle, 1 in rear
Investigation is required to determine optimum location for baggage.

(f) 5 Occupants - 1 in front, 2 in middle, 2 in rear
Load forward baggage to capacity first. Rear baggage and/or fuel load may be limited by aft envelope.

(g) 6 Occupants - 2 in front, 2 in middle, 2 in rear
With six occupants fuel and/or baggage may be limited by envelope load forward baggage compartment to capacity first.

(h) 7 Occupants - 2 in front, 3 in middle, 2 in rear
With seven occupants fuel and/or baggage may be limited by envelope.

For all airplane configurations, it is the responsibility of the pilot in command to make sure that the airplane always remains within the allowable weight vs. center of gravity envelope while in flight.

6.9 WEIGHT AND BALANCE DETERMINATION FOR FLIGHT

(a) Add the weight of all items to be loaded to the basic empty weight.

(b) Use the Loading Graph (Figure 6-13) to determine the moment of all items to be carried in the airplane.

(c) Add the moment of all items to be loaded to the basic empty weight moment.

(d) Divide the total moment by the total weight to determine the C.G. location.

(e) By using the figures of item (a) and item (d) (above), locate a point on the C.G. range and weight graph (Figure 6-15). If the point falls within the C.G. envelope, the loading meets the weight and balance requirements.

NOTES

Actual fuel allowance for start-up, taxi and run-up (23 lbs. max.) should be determined based on local operating condition.

Moment due to gear retraction does not significantly affect C.G. location.

	Weight (Lbs.)	Arm Aft Datum (Inches)	Moment (In-Lbs)
Basic Empty Weight	3212	88.5	284262
Pilot and Front Passenger	340	85.5	29070
Passengers (Center Seats) (Forward Facing)		118.1	
Passengers (Center Seats) (Aft Facing) (Optional)	236	119.1	28108
Passengers (Rear Seats)	340	157.6	53585
Passenger (Jump Seat) (Optional)		118.1	
Baggage (Forward) (100 Lbs. Max.)	100	22.5	2250
Baggage (Aft) (100 Lbs. Max.)		178.7	
Zero Fuel Weight (4470 Lbs. Max - Std) (See equipment list.)	4228	94.0	397275
Fuel (93 Gal. Max.) - Std. (123 Gal. Max.) - Opt.	545	93.6	51012
Ramp Weight (4773 Lbs. Max.)	4773	93.9	448287
Fuel Allowance for Start, Taxi, Runup	-23	95.0	-2185
Takeoff Weight (4750 lbs. Max.)	4750	93.9	446102

The center of gravity (C.G.) of this sample loading problem is at 93.9 inches aft of the datum line. Locate this point (93.9) on the C.G. range and weight graph. Since this point falls within the weight - C.G. envelope, this loading meets the weight and balance requirements.

Takeoff Weight (4750 Lbs. Max.)	4750	93.9	446102
Minus Estimated Fuel Burnoff @ Approximately 90 lbs. per hr.	-450	95.0	-42750
Landing Weight (4513 Lbs. Max.)	4300	93.8	403352

Locate the center of gravity for the landing weight on the C.G. range and weight graph. If this point falls within the weight C.G. envelope, the loading may be assumed acceptable for landing.

IT IS THE RESPONSIBILITY OF THE PILOT AND AIRCRAFT OWNER TO INSURE THAT THE AIRPLANE IS LOADED PROPERLY.

SAMPLE LOADING PROBLEM
Figure 6-9

	Weight (Lbs.)	Arm Aft Datum (Inches)	Moment (In-Lbs)
Basic Empty Weight			
Pilot and Front Passenger		85.5	
Passengers (Center Seats) (Forward Facing)		118.1	
Passengers (Center Seats) (Aft Facing) (Optional)		119.1	
Passengers (Rear Seats)		157.6	
Passenger (Jump Seat) (Optional)		118.1	
Baggage (Forward) (100 Lbs. Max.)		22.5	
Baggage (Aft) (100 Lbs. Max.)		178.7	
Zero Fuel Weight (4470 Lbs. Max - Std) (See equipment list.)			
Fuel (93 Gal. Max.) - Std. (123 Gal. Max.) - Opt.		93.6	
Ramp Weight (4773 Lbs. Max.)			
Fuel Allowance for Start, Taxi, Runup	-23	95.0	-2185
Takeoff Weight (4750 lbs. Max.)			

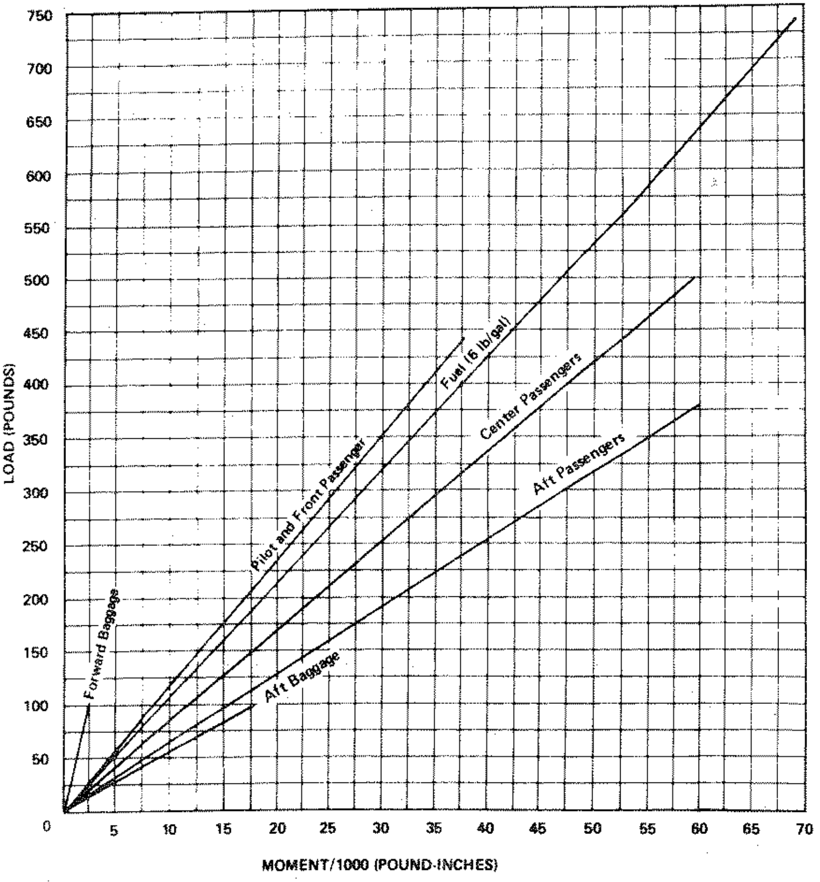
The center of gravity (C.G.) for the takeoff weight of the actual loading problem is at inches aft of the datum line. Locate this point ( ) on the C.G. range and weight graph. If this point falls within the weight - C.G. envelope, this loading meets the weight and balance requirements.

	Weight (Lbs.)	Arm Aft Datum (Inches)	Moment (In-Lbs)
Takeoff Weight (4750 Lbs. Max.)			
Minus Estimated Fuel Burnoff @ Approximately 90 lbs. per hr.		95.0	
Landing Weight (4513 Lbs. Max.)			

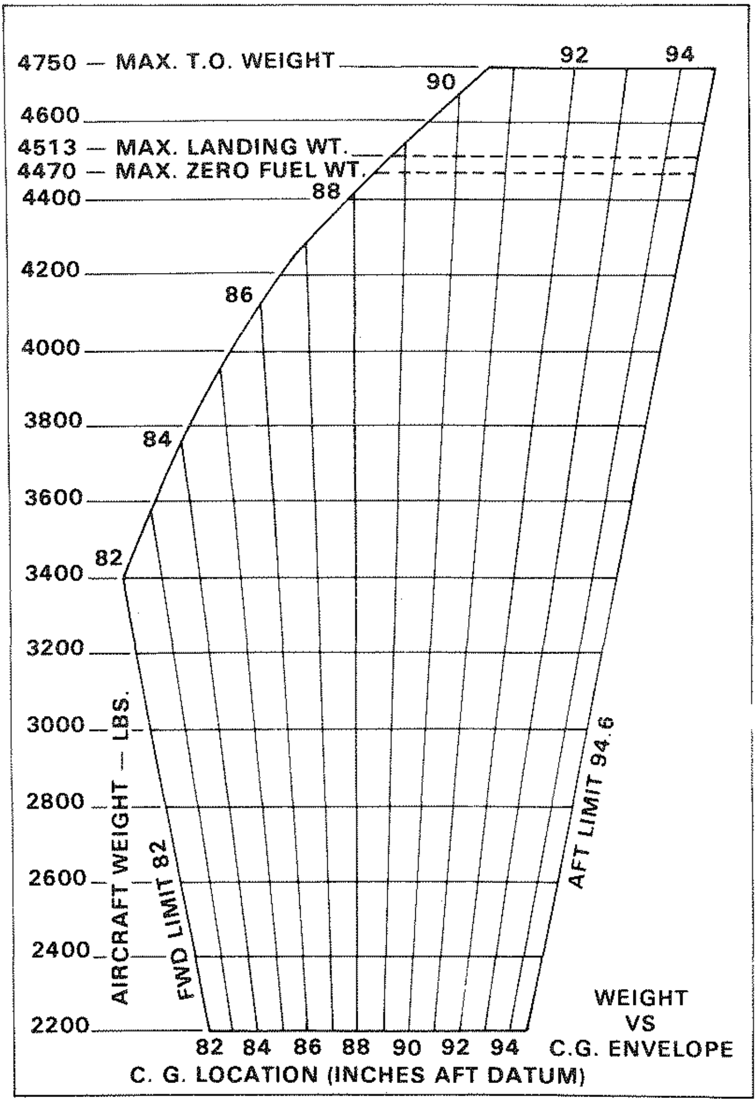
Locate the center of gravity for the landing weight on the C.G. range and weight graph. If this point falls within the weight C.G. envelope, the loading may be assumed acceptable for landing.

IT IS THE RESPONSIBILITY OF THE PILOT AND AIRCRAFT OWNER TO INSURE THAT THE AIRPLANE IS LOADED PROPERLY.

WEIGHT AND BALANCE LOADING FORM
Figure 6-11



LOADING GRAPH
Figure 6-13



Moment change due to retracting Landing Gear = -32 in. - lbs.

C.G. RANGE AND WEIGHT
Figure 6-15

6.11 INSTRUCTIONS FOR USING THE WEIGHT AND BALANCE PLOTTER

This plotter is provided to enable the pilot quickly and conveniently to:

(a) Determine the total weight and C.G. position.

(b) Decide how to change his load if his first loading is not within the allowable envelope.

Heat can warp or ruin the plotter if it is left in the sunlight. Replacement plotters may be purchased from Piper dealers and distributors.

The "Basic Empty Weight and Center of Gravity" location is taken from the Weight and Balance Form (Figure 6-5), the Weight and Balance Record (Figure 6-7) or the latest FAA major repair or alteration form.

The plotter enables the user to add weights and corresponding moments graphically. The effect of adding or disposing of useful load can easily be seen. The plotter does not cover the situation where cargo is loaded in locations other than on the seats or in the baggage compartments.

Brief instructions are given on the plotter itself. To use it, first plot a point on the grid to locate the basic weight and C.G. location. This can be put on more or less permanently because it will not change until the airplane is modified. Next, position the zero weight end of one of the six slots over this point. Using a pencil, draw a line along the slot to the weight which will be carried in that location. Then position the zero weight end of the next slot over the end of this line and draw another line representing the weight which will be located in this second position. When all the loads have been drawn in this manner, the final end of the segmented line locates the total load and the C.G. position of the airplane for takeoff. If this point is not within the allowable envelope it will be necessary to remove fuel, baggage, or passengers and/or to rearrange baggage and passengers to get the final point to fall within the envelope.

Fuel burn-off and gear movement do not significantly affect the center of gravity.

SAMPLE PROBLEM

A sample problem will demonstrate the use of the weight and balance plotter.

Assume a basic weight and C.G. location of 2850 pounds at 83.5 inches respectively. We wish to carry a pilot and 5 passengers. Two men weighing 180 and 200 pounds will occupy the front seats, two women weighing 115 and 135 pounds will occupy the middle seats and two children weighing 80 and 100 pounds will ride in the rear. Two 25 pound suitcases will be tied down in the front baggage compartment and two suitcases weighing 25 pounds and 20 pounds respectively, will be carried in the rear compartment. We wish to carry 60 gallons of fuel. Will we be within the safe envelope?

(a) Place a dot on the plotter grid at 2850 pounds and 83.5 inches to represent the basic airplane. (See illustration.)

(b) Slide the slotted plastic into position so that the dot is under the slot for the forward seats, at zero weight.

(c) Draw a line up the slot to the 380 pounds position (180 + 200) and put a dot.

(d) Move the slotted plastic again to get the zero end of the middle seat slot over this dot.

(e) Draw a line up this slot to the 250 pound position (115 + 135) and place the 3rd dot.

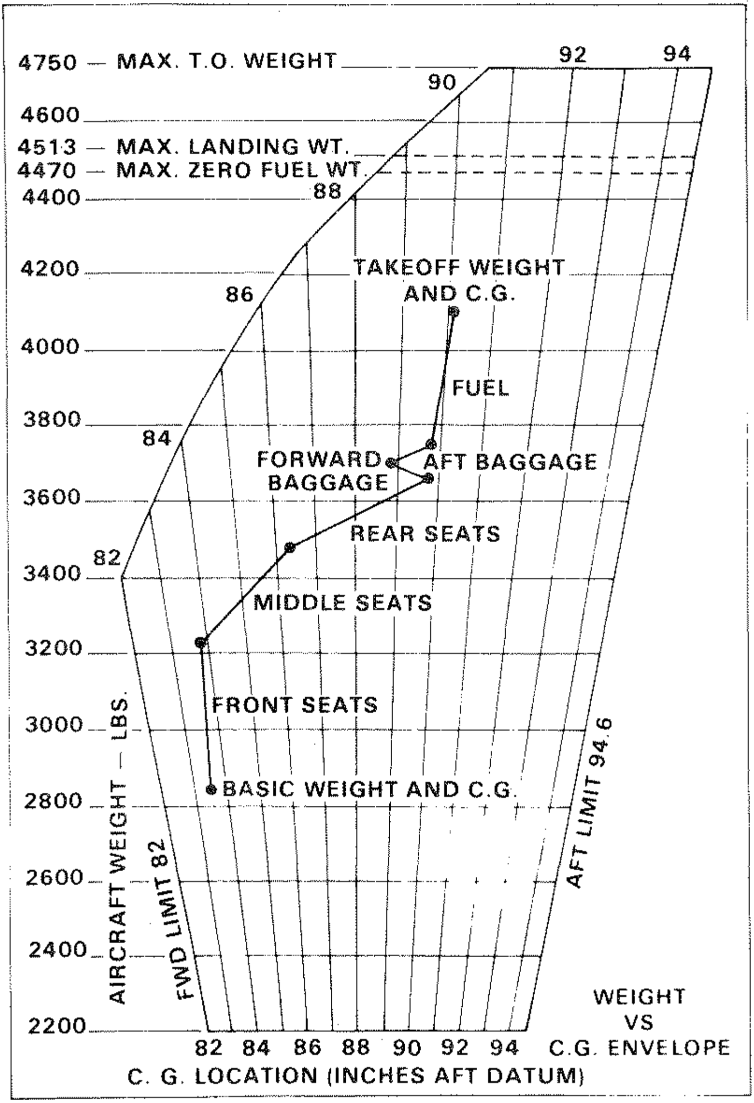
(f) Continue moving the plastic and plotting points to account for weight in the rear seats (80 + 100), forward baggage compartment (50), rear baggage compartment (45), and fuel tanks (360).

(g) As can be seen from the illustration, the final dot shows the total weight to be 4115 pounds with the C.G. at 90.1. This is well within the envelope.

(h) There will be room for more fuel.

As fuel is burned off, the weight and C.G. will follow down the fuel line and stay within the envelope for landing.

SAMPLE PROBLEM



Moment change due to retracting Landing Gear = -32 in. -lbs.

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TABLE OF CONTENTS

SECTION 7

DESCRIPTION AND OPERATION OF THE AIRPLANE AND ITS SYSTEMS

SECTION 7

DESCRIPTION AND OPERATION OF THE AIRPLANE AND ITS SYSTEMS

7.1 THE AIRPLANE

The Seneca III is a twin-engine, all metal, retractable landing gear, turbocharged airplane. It has seating for up to seven occupants and two separate one hundred pound luggage compartments.

7.3 AIRFRAME

The basic airframe is of aluminum alloy with steel engine mounts and landing gear and thermo-plastic or fiberglass fairings. Aerobatics are prohibited in this airplane since the structure is not designed for aerobatic loads.

The fuselage is a semi-monocoque structure. There is a front door on the right side and a rear door on the left. A cargo door is installed aft of the rear passenger door. Both rear doors may be opened for loading large pieces of cargo. A door on the left side of the nose section gives access to the nose section baggage compartment.

The wing is of a conventional design and employs a laminar flow NACA 65_2-415 airfoil section. The main spar is located at approximately 40% of the chord aft of the leading edge. The wings are attached to the fuselage by the insertion of the butt ends of the spar into a spar box carry-through, which is an integral part of the fuselage structure. The bolting of the spar ends into the spar box carry-through structure, which is located under the center seats, provides in effect a continuous main spar. The wings are also attached fore and aft of the main spar by an auxiliary front spar and a rear spar. The rear spar, in addition to taking torque and drag loads, provides a mount for flaps and ailerons. The four-position wing flaps are mechanically controlled by a handle located between the front seats. When fully retracted, the right flap locks into place to provide a step for cabin

entry. Each wing contains two fuel tanks as standard equipment. An optional third tank may be installed on each side. The tanks on one side are filled through a single filler neck located well outboard of the engine nacelle.

A vertical stabilizer, an all-movable horizontal stabilator, and a rudder make up the empennage. The stabilator incorporates an anti-servo tab which improves longitudinal stability and provides longitudinal trim. This tab moves in the same direction as the stabilator, but with increased travel. Rudder effectiveness is increased by an anti-servo tab on the rudder.

7.5 ENGINES

The Seneca III is powered by two Teledyne Continental six-cylinder turbocharged engines each rated at 200 horsepower at 2600 RPM maximum continuous at sea level and 220 horsepower at 2800 RPM takeoff power for five minutes. The engines are air cooled and fuel injected and are equipped with oil coolers with low temperature bypass systems and engine mounted oil filters. A winterization plate is provided to restrict air during winter operation. (See Winterization in Handling and Servicing Section.) Asymmetric thrust during takeoff and climb is eliminated by the counter-rotation of the engines, the left engine rotating in a clockwise direction when viewed from the cockpit, and the right engine rotating counterclockwise.

The engines are accessible through removable panels, one on either side of each engine cowling. Engine mounts are constructed of steel tubing, and dynafocal engine mounts are provided to reduce vibration.

A Ray-Jay turbocharger on each engine is operated by exhaust gases. Exhaust gases rotate a turbine wheel, which in turn drives an air compressor. Induction air is compressed (supercharged) and distributed into the engine air manifold, and the exhaust gases which drive the compressor are discharged overboard. Engine induction air is taken from within the cowling, is filtered, and is then directed into the turbocharger compressor inlet. Each engine cylinder is supplied with pressurized air in operation from sea level to maximum operating altitude. The pressure relief valve protects the engine from inadvertently exceeding 42 inches Hg; 40 inches Hg is manually set with the throttles. The turbo bypass orifice is preset for 40 inches Hg at 12,000 feet density altitude at full throttle and 2600 RPM.

The intake filter air box incorporates a manually operated two-way valve designed to allow induction air either to pass into the compressor through the filter or to bypass the filter and supply heated air directly to the turbocharger. There is an automatic alternate air door which opens in the event that the primary air source becomes blocked. Alternate air selection ensures induction air flow should the filter become blocked. Since the air is heated, the alternate air system offers protection against induction system blockage caused by snow or freezing rain, or by the freezing of moisture accumulated in the induction air filter. Alternate air is unfiltered; therefore, it should not be used during ground operation when dust or other contaminants might enter the system. The primary (through the filter) induction source should always be used for takeoffs.

The fuel injection system incorporates a metering system which measures the rate at which turbocharged air is being used by the engine and dispenses fuel to the cylinders proportionally. Fuel is supplied to the injector pump at a greater rate than the engine requires. The excess fuel is returned to the fuel tank by the vapor return line. The fuel injection system is a "continuous flow" type.

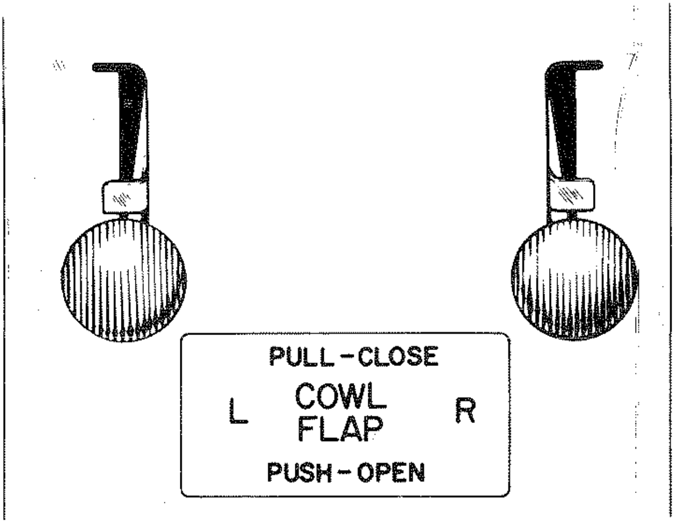
To obtain maximum efficiency and time between overhauls from the engines, follow the procedures recommended in the Teledyne Continental Operator's Manual provided with the airplane.

Engine controls consist of a throttle, a propeller control and a mixture control lever for each engine. These controls are located on the control quadrant on the lower center of the instrument panel where they are accessible to both the pilot and the copilot. The controls utilize teflon-lined control cables to reduce friction and binding.

The throttle levers are used to adjust the manifold pressure. They incorporate a gear up warning horn switch which is activated during the last portion of travel of the throttle levers to the low power position. If the landing gear is not locked down, the horn will sound until the gear is down and locked or until the power setting is increased. This is a safety feature to warn the pilot of an inadvertent gear up landing.

All throttle operations should be made with a smooth, not too rapid movement to prevent unnecessary engine wear or damage to the engines, and to allow time for the turbocharger speed to stabilize.

The propeller control levers are used to adjust the propeller speed from high RPM to feather.



COWL FLAP CONTROL
Figure 7-1

The mixture control levers are used to adjust the air to fuel ratio. An engine is shut down by the placing of the mixture lever in the full lean (idle cut-off) position.

The friction adjustment lever on the right side of the control quadrant may be adjusted to increase or decrease the friction holding the throttle, propeller, and mixture controls or to lock the controls in a selected position.

The alternate air controls are located on the control quadrant just below the engine control levers. When an alternate air lever is in the up, or off, position the engine is operating on filtered air; when the lever is in the down, or on, position the engine is operating on unfiltered, heated air. Should the primary air source become blocked the automatic alternate air door will automatically select unfiltered heated air.

The cowl flap control levers (Figure 7-1), located below the control quadrant, are used to regulate cooling air for the engines. The levers have three positions: full open, full closed, and intermediate. A lock incorporated

in each control lever locks the cowl flap in the selected position. To operate the cowl flaps, depress the lock and move the lever toward the desired setting. Release the lock after initial movement and continue movement of the lever. The control will stop and lock into place at the next setting. The lock must be depressed for each selection of a new cowl flap setting. The intermediate lever position is used for climb and single engine operation. The full open position is available when abnormal temperatures are encountered.

7.7 PROPELLERS

Counter-rotation of the propellers provides balanced thrust during takeoff and climb and eliminates the "critical engine" factor in single engine flight.

Two-blade, constant speed, controllable pitch and feathering Hartzell propellers are installed as standard equipment. The propellers mount directly to the engine crankshafts. Pitch is controlled by oil and nitrogen pressure. Oil pressure sends a propeller toward the high RPM or unfeather position; nitrogen pressure sends a propeller toward the low RPM or feather position and also prevents propeller overspeeding. The recommended nitrogen pressure to be used when charging the unit is listed on placards on the propeller domes and inside the spinners. This pressure varies with ambient temperature at the time of charging. Although dry nitrogen gas is recommended, compressed air may be used provided it contains no moisture. For more detailed instructions, see "Propeller Service" in the Handling and Service Section of this handbook.

Governors, one on each engine, supply engine oil at various pressures through the propeller shafts to maintain constant RPM settings. A governor controls engine speed by varying the pitch of the propeller to match load torque to engine torque in response to changing flight conditions.

Each propeller is controlled by the propeller control levers located in the center of the power control quadrant. Feathering of a propeller is accomplished by moving the control fully aft through the low RPM detent, into the "FEATHER" position. Feathering takes place in approximately six seconds. Unfeathering is accomplished by moving the propeller control forward and engaging the starter until the propeller is windmilling.

An optional propeller unfeathering system may be installed which consists of increased capacity governors, gas charged accumulators and a latching propeller control lever.

The feathering governors are designed to operate in the conventional manner in addition to their accumulator unfeathering capability.

The accumulators store engine oil under pressure from the governors which is released back to the governors for propeller unfeathering when the propeller control lever is unlatched and moved forward from the feathered position.

The feathering latches hold the propeller control lever in the feathered position and prevent inadvertent unfeathering. These latches must be manually released (pushed forward) to unfeather the propeller but do not change the feathering procedure.

With this system installed the feathering time is 10 - 17 seconds and unfeathering times is 8 - 12 seconds depending on the oil temperature.

A feathering lock, operated by centrifugal force, prevents feathering during engine shut down by making it impossible to feather any time the engine speed falls below 800 RPM. For this reason, when airborne, and the pilot wishes to feather a propeller to save an engine, he must be sure to move the propeller control into the "FEATHER" position.

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7.9 LANDING GEAR

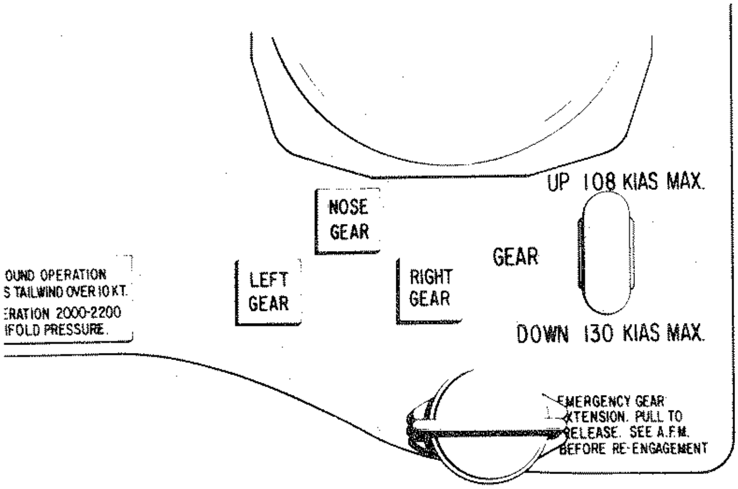
The Seneca III is equipped with hydraulically operated, fully retractable, tricycle landing gear.

Hydraulic pressure for gear operation is furnished by an electrically powered, reversible hydraulic pump (refer to Figures 7-5 and 7-7). The pump is activated by a two-position gear selector switch located to the left of the control quadrant on the instrument panel (Figure 7-3). The gear selector switch, which has a wheel-shaped knob, must be pulled out before it is moved to the "UP" or "DOWN" position. When hydraulic pressure is exerted in one direction, the gear is retracted; when it is exerted in the other direction, the gear is extended. Gear extension or retraction normally takes six to seven seconds.

CAUTION

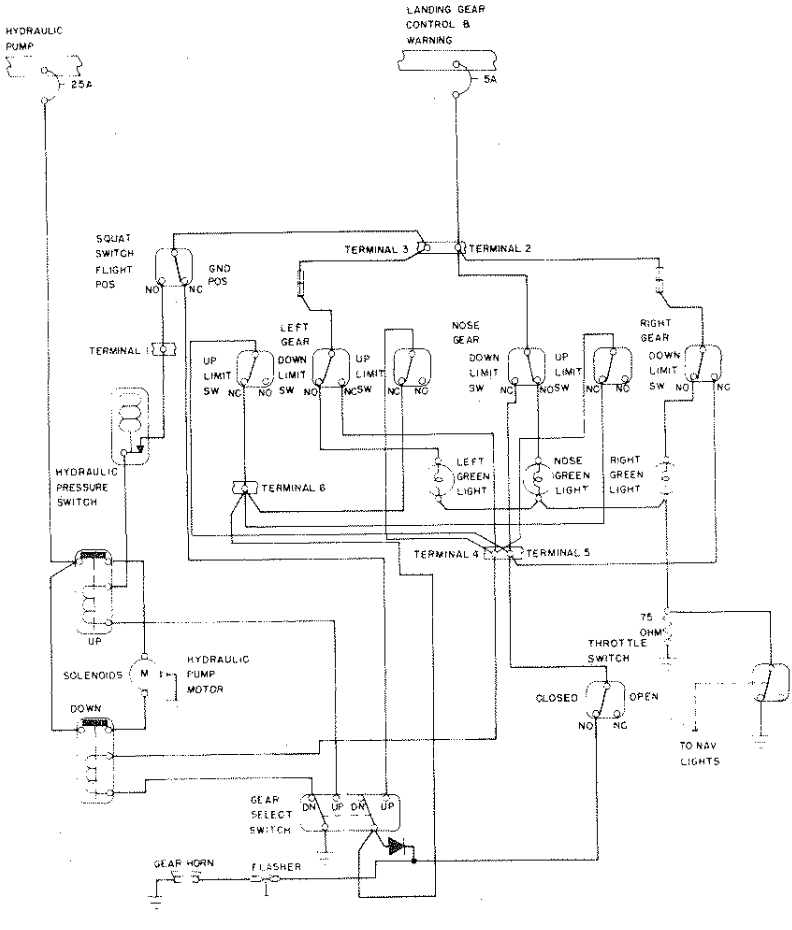
If the landing gear is in transit, and the hydraulic pump is running, it is NOT advisable to move the gear selector switch to the opposite position before the gear has reached its full travel limit, because a sudden reversal may damage the electric pump.

The landing gear is designed to extend even in the event of hydraulic failure. Since the gear is held in the retracted position by hydraulic pressure, should the hydraulic system fail for any reason, gravity will allow the gear to extend. When the landing gear is retracted, the main wheels retract inboard into the wings and the nose wheel retracts forward into the nose section. Aerodynamic loads and springs assist in gear extension and in locking the gear in the down position. During gear extension, once the nose has started toward the down position, the airstream pushes against it and assists in moving it to the downlocked position. After the gears are down and the downlock hooks engage, springs maintain force on each hook to keep it locked until it is released by hydraulic pressure.

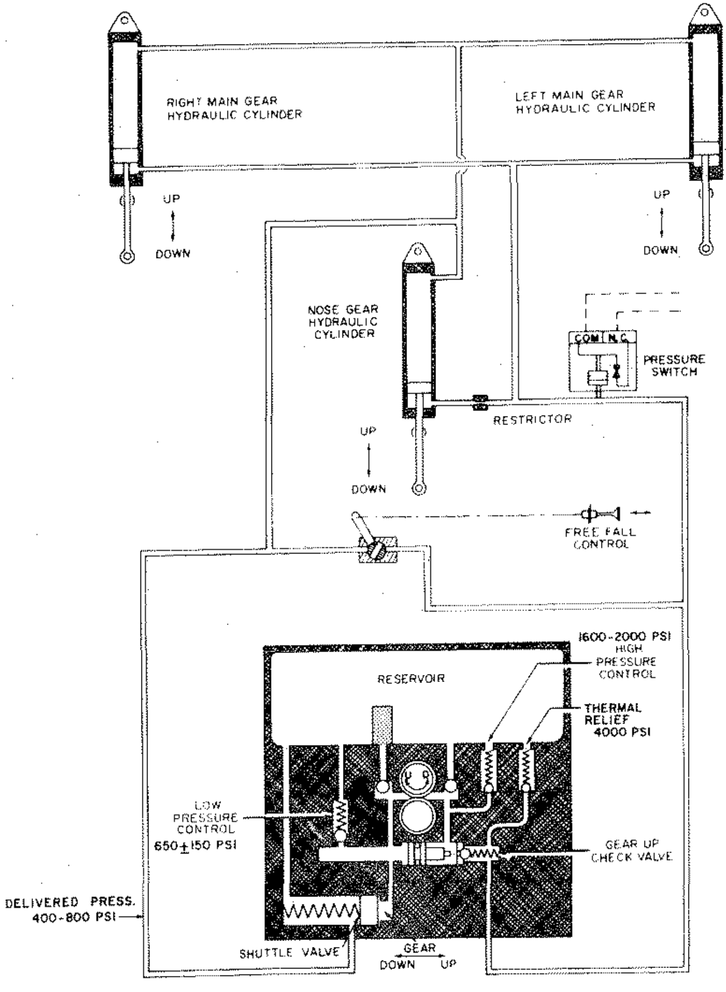


LANDING GEAR SELECTOR
Figure 7-3

To extend and lock the gears in the event of hydraulic failure, it is necessary only to relieve the hydraulic pressure. Emergency gear extension must not be attempted at airspeeds in excess of 85 KIAS. An emergency gear extension knob, located directly beneath the gear selector switch is provided for this purpose. Pulling this knob releases the hydraulic pressure holding the gear in the up position and allows the gear to fall free. During normal operation, this knob is covered by a guard to prevent inadvertent extension of the gear. Before pulling the emergency gear extension knob, place the landing gear selector switch in the "DOWN" position to prevent the pump from trying to raise the gear. If the emergency gear knob has been pulled out to lower the gear by gravity, due to a gear system malfunction, leave the control in its extended position until the airplane has been put on jacks to check the proper function of the landing gears hydraulic and electrical systems. See Aircraft Service Manual for proper landing gear system check out procedures. If the airplane is being used for training purposes or a pilot check out mission, and the emergency gear extension has been pulled out, it may be pushed in again when desired if there has not been any apparent malfunction of the landing gear system.



LANDING GEAR ELECTRICAL SYSTEM SCHEMATIC
Figure 7-5



LANDING GEAR HYDRAULIC SYSTEM SCHEMATIC
Figure 7-7

When the gear is fully extended or fully retracted and the gear selector is in the corresponding position, electrical limit switches stop the flow of current to the motor of the hydraulic pump. The three green lights to the left of the landing gear selector switch illuminate to indicate that each of the three landing gears is down and locked. A convex mirror on the left engine nacelle both serves as a taxiing aid and allows the pilot to visually confirm the condition of the nose gear. If the gear is in neither the full up nor the full down position, a red warning light on the instrument panel illuminates. Should the throttle be placed in a low setting - as for a landing approach - while the gear is retracted, a warning horn sounds to alert the pilot that the gear is retracted. The gear warning horn emits a 90 cycle per minute beeping sound.

The green gear lights are dimmed automatically when the navigation lights are turned on. For this reason, if the navigation lights are turned on in the daytime, it is difficult to see the landing gear lights. If the green lights are not observed after the landing gear selector switch is placed in the "DOWN" position, the first thing to check is the position of the navigation lights switch.

If one or two of the three green lights do not illuminate when the gear down position has been selected, any of the following conditions could exist for each light that is out:

(a) The gear is not locked down.
(b) A bulb is burned out.
(c) There is a malfunction in the indicating system.

In order to check the bulbs, the square indicator lights can be pulled out and interchanged.

A micro switch incorporated in the throttle quadrant activates the gear warning horn under the following conditions:

(a) The gear is not locked down and the manifold pressure has fallen below 14 inches on either one or both engines.
(b) The gear selector switch is in the "UP" position when the airplane is on the ground.

To prevent inadvertent gear retraction should the gear selector switch be placed in the "UP" position when the airplane is on the ground, a squat switch located on the left main gear will prevent the hydraulic pump from actuating if the master switch is turned on. On takeoff, when the landing gear oleo strut drops to its full extension, the safety switch closes to complete the

circuit which allows the hydraulic pump to be activated to raise the landing gear when the gear selector is moved to the "UP" position. During the preflight check, be sure the landing gear selector is in the "DOWN" position and that the three green gear indicator lights are illuminated. On takeoff, the gear should be retracted before an airspeed of 108 KIAS is exceeded. The landing gear may be lowered at any speed up to 130 KIAS.

The hydraulic reservoir for landing gear operation is an integral part of the gear hydraulic pump. Access to the combination pump and reservoir is through a panel in the nose baggage compartment. For filling instructions, see the PA-34-220T Service Manual.

The nose gear is steerable through a 27 degree arc either side of center by use of a combination of full rudder pedal travel and brakes. A gear centering spring, incorporated in the nose gear steering system, prevents shimmy tendencies. A bungee assembly reduces ground steering effort and dampens shocks and bumps during taxiing. When the gear is retracted, the nose wheel centers as it enters the wheel well, and the steering linkage disengages to reduce pedal loads in flight. The landing light turns off automatically when the gear is retracted.

All three landing gears carry 6.00 x 6 tires. The nose wheel has a 6-ply tire and the main wheels have 8-ply tires. For information on servicing the tires, see "Tire Inflation" in the Handling and Servicing Section of this handbook.

Struts for the landing gear are air-oil assemblies. Strut exposure should be checked during each preflight inspection. If a need for service or adjustment is indicated, refer to the instructions printed on the units. Should more detailed landing gear service information be required, refer to the PA-34-220T Service Manual.

7.11 BRAKE SYSTEM

Two single-disc, double puck brake assemblies, one on each main gear, are actuated by toe brake pedals mounted on both the pilot's and the copilot's rudder pedals. A brake system hydraulic reservoir, independent of the landing gear hydraulic reservoir, is located behind a panel in the rear top of the nose baggage compartment. Brake fluid should be maintained at the level marked on the reservoir. For further information see "Brake Service" in the Handling and Servicing Section of this handbook.

The parking brake knob is located on the lower left instrument panel. To set the parking brake, first depress and hold the toe brake pedals and then pull out the parking brake knob. To release the parking brake, first depress and hold the toe brake pedals and then push in on the parking brake knob.

WARNING

No braking will occur if knob is pulled prior to brake application.

7.13 FLIGHT CONTROL SYSTEM

Dual flight controls are installed in the Seneca III as standard equipment. The controls actuate the control surfaces through a cable system. The horizontal tail surface (stabilator) is of the all movable slab type with an anti-servo tab mounted on the trailing edge. This tab, actuated by a control mounted on the console between the front seats, also acts as a longitudinal trim tab (refer to Figure 7-9).

The ailerons are of the Frise type. This design allows the leading edge of the aileron to extend into the airstream to provide increased drag and improved roll control. The differential deflection of the ailerons tends to eliminate adverse yaw in turning maneuvers and to reduce the amount of coordination required in normal turns.

The vertical tail is fitted with a rudder which incorporates a combination rudder trim and anti-servo tab. The rudder trim control is located on the control console between the front seats.

The flaps are manually operated and spring loaded to return to the retracted position. A four-position flap control lever (Figure 7-9) between the front seats adjusts the flaps for reduced landing speeds and glide path control. The flaps have three extended positions - 10, 25 and 40 degrees - as well as the fully retracted position. A button on the end of the lever must be depressed before the control can be moved. A past center lock incorporated in the actuating linkage holds the flap when it is in the retracted position so

CONSOLE
Figure 7-9

that it may be used as a step on the right side. Since the flap will not support a step load except in the fully retracted position, the flaps should be retracted when people are entering or leaving the airplane.

7.15 FUEL SYSTEM

Fuel is stored in fuel tanks located in each wing. The tanks in each wing are interconnected to function as a single tank (refer to Figure 7-11). All tanks on each side are filled through a single filler in the outboard tank, and as fuel is consumed from the inboard tank, it is replenished by fuel from outboard. Only two and one half gallons of fuel in each wing is unusable, giving the Seneca III a total of 93 usable gallons with standard fuel tanks or 123 usable gallons with the optional fuel tanks installed. The minimum fuel grade is 100 or 100LL Aviation Grade. The fuel tank vents, one installed under each wing, feature an anti-icing design to prevent ice formation from blocking the fuel tank vent lines.

The fuel injection system is a "continuous flow" type that utilizes a vapor return line leading back to the fuel tanks. This line provides a route back to the tanks for vapor laden fuel that has been separated in the injector pump swirl chamber. Each engine has an engine-driven fuel pump that is a part of the fuel injection system. An auxiliary fuel system is provided. The purpose of the electrically powered auxiliary fuel system is to supply fuel to the engine in case of engine-driven fuel pump shaft failure or malfunction, for ground and inflight engine starting, and for vapor suppression. The two auxiliary fuel pump switches are located on the lower left side of the instrument panel and are three-position rocker switches: LO, HI and OFF. The LO auxiliary fuel pressure is selected by pushing the top of the switch. The HI auxiliary fuel pressure is selected by pushing the bottom of the switch, but this can be done only after unlatching the adjacent guard. When the HI auxiliary fuel pump is activated, an amber light near the annunciation panel is illuminated for each pump. These lights dim whenever the pump pressure reduces automatically and manifold pressure is below approximately 21 inches.

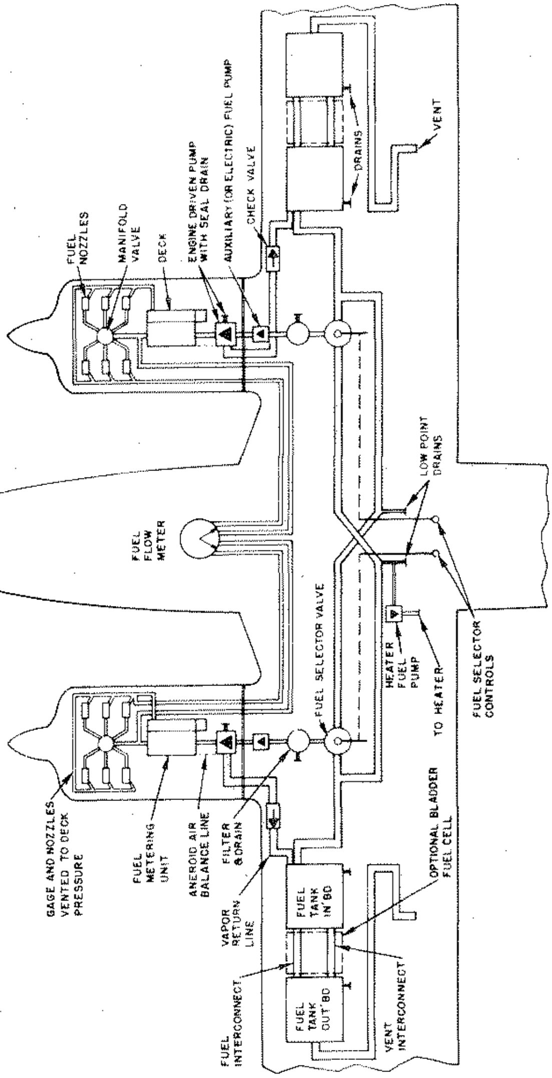
In case of a failed engine-driven fuel pump, HI auxiliary fuel pressure should be selected. Adequate pressure and fuel flow will be supplied for up to approximately 75% power. Manual leaning to the correct fuel flow will be required at altitudes above 15,000 feet and for engine speeds less than 2300 RPM. An absolute pressure switch automatically selects a lower fuel pressure when the throttle is reduced below 21" Hg manifold pressure and the HI auxiliary fuel pump is on.

NOTE

> Excessive fuel pressure and very rich fuel/air mixtures will occur if the HI position is energized when the engine fuel injection system is functioning normally.

Low auxiliary fuel pressure is available and may be used during normal engine operation both on the ground and inflight for vapor suppression should it be necessary as evidenced by unstable engine operation or fluctuating fuel flow indications during idle or at high altitudes.

Separate spring loaded OFF primer button switches, located adjacent to the starter switches, are used to select HI auxiliary fuel pump operation for priming, regardless of other switch positions. These primer buttons may be used for both hot or cold engine starts.



FUEL SYSTEM SCHEMATIC
Figure 7-11

On airplanes equipped with an optional primer system (identified by Placard below starter switch shown in Figure 7-15), the primer switch location and actuation is the same as the basic airplane. However, this system does provide a separate primer system as an integral part of the engine fuel system. An electrically operated diverter valve is located in the metered fuel supply line between the air throttle valve and the manifold valve. Other components are two primer nozzles, located in the intake manifold on each side of the engine, and the interconnecting fuel lines. Actuation of the engine primer switch operates the auxiliary electric fuel pump on HI and energizes the diverter valve which supplies fuel to each primer nozzle. The diverter valve does not shut off fuel flow to the manifold valve, therefore some quantity of fuel is also supplied to each cylinder nozzle during priming. Normal operation of the auxiliary fuel pump is unchanged.

Fuel management controls are located on the console between the front seats. There is a control lever for each of the engines, and each is placarded ON - OFF - X FEED. During normal operation, the levers are in the ON position, and each engine draws fuel from the tanks on the same side as the engine. The two fuel systems are interconnected by crossfeed lines. When the X FEED position is selected, the engine will draw fuel from the tanks on the opposite side in order to extend range and keep fuel weight balanced during single-engine operation. The OFF position shuts off the fuel flow from a side.

NOTE

When one engine is inoperative and the fuel selector for the operating engine is on X FEED the selector for the inoperative engine must be in the OFF position. Do not operate with both selectors on X FEED. Do not take off with a selector on X FEED. Fuel and vapor are always returned to the tank on the same side as the operating engine.

Before each flight, fuel must be drained from low points in the fuel system to ensure that any accumulation of moisture or sediment is removed from the system. Fuel drains are provided for each fuel filter (2), each fuel tank (4), and each crossfeed line (2). The fuel filter drains are located on the outboard underside of each engine nacelle; two fuel tank drains are located on the underside of each wing; fuel crossfeed drains are located at the lowest point in the fuel system, on the underside of the fuselage, just inboard of the trailing edge of the right wing flap.

7.17 ELECTRICAL SYSTEM

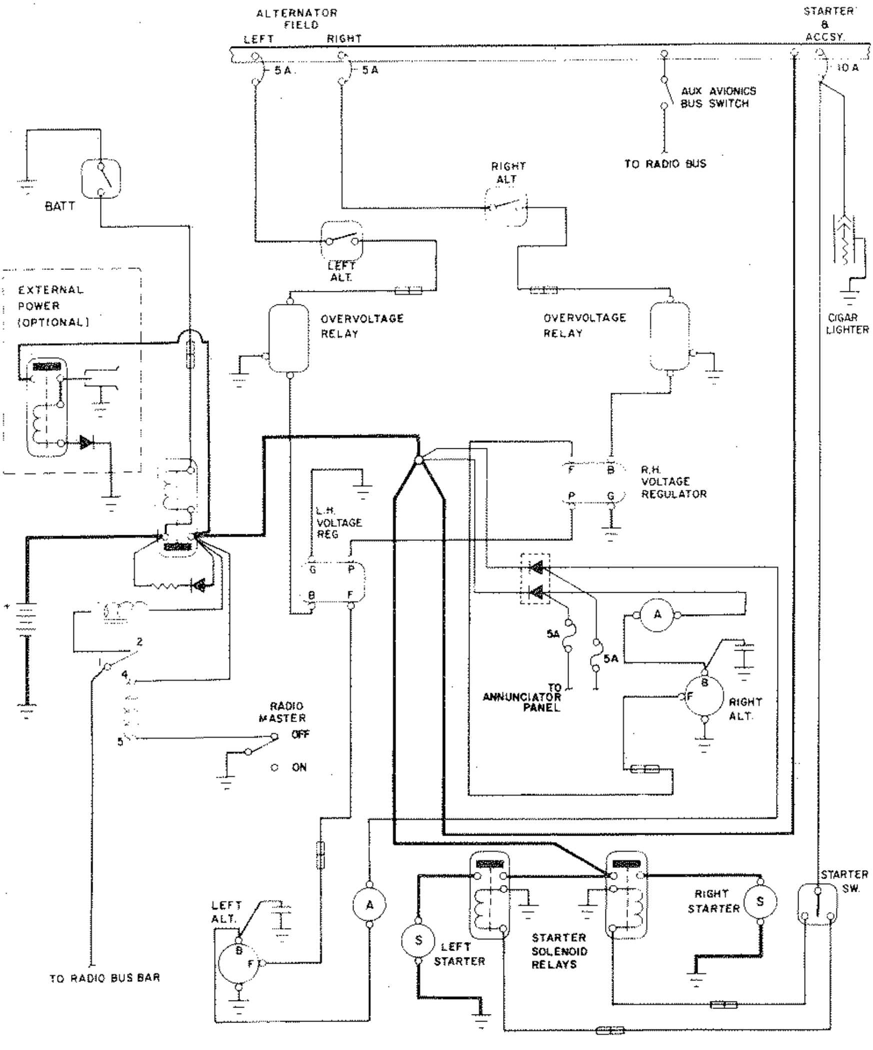
The electrical system of the Seneca III is capable of supplying sufficient current for complete night IFR equipment. Electrical power is supplied by two 65 ampere alternators (Figure 7-13), one mounted on each engine. A 35 ampere-hour, 12 volt battery provides current for starting, for use of electrical equipment when the engines are not running, and for a source of stored electrical power to back up the alternator output. The battery, which is located in the nose section and is accessible through the baggage compartment, is normally kept charged by the alternators. If it becomes necessary to charge the battery, it should be removed from the airplane.

Two solid state voltage regulators maintain effective load sharing while regulating electrical system bus voltage to 14 volts. An overvoltage relay in each alternator circuit prevents damage to electrical and avionics equipment by taking an alternator off the line if its output exceeds 17 volts. If this should occur, the alternator light on the annunciator panel will illuminate. Voltage regulators and overvoltage relays are located forward of the bottom of the bulkhead separating the cabin section from the nose section.

The electrical system and equipment are protected by circuit breakers located on a circuit breaker panel on the lower right side of the instrument panel. The circuit breaker panel is provided with enough blank spaces to accommodate additional circuit breakers if extra electrical equipment is installed. In the event of equipment malfunctions or a sudden surge of current, a circuit breaker can trip automatically. The pilot can reset the breaker by pressing it in (preferably after a few minutes cooling period). The circuit breakers can be pulled out manually.

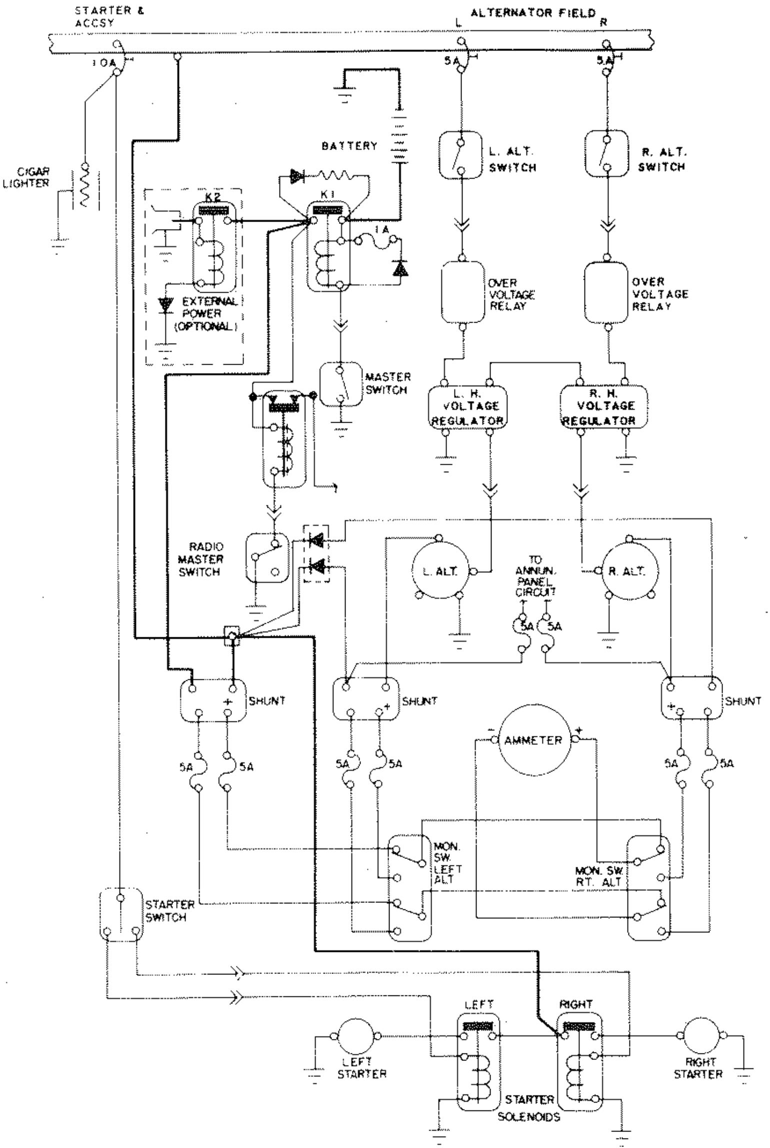
Most of the electrical switches, including the battery switch and switches for magnetos, fuel pumps, starters, alternators, lights and pitot heat, are conveniently located on the switch panel (Figure 7-15) to the left of the pilot's control wheel.

An optional starting installation known as Piper External Power (PEP) is accessible through a receptacle located on the lower left side of the nose section. An external battery can be connected to the socket, thus allowing the operator to crank the engine without having to gain access to the airplane's battery.



ALTERNATOR AND STARTER SCHEMATIC
S/N 34-8133001 THRU 34-8233205

Figure 7-13



ALTERNATOR AND STARTER SCHEMATIC
S/N 34-8333001 AND UP
Figure 7-14

An optional cabin courtesy light system consists of a front entrance light over the forward cabin door and rear entrance light, which replaces the reading light over the aft cabin door. These lights are operated individually with switches that are incorporated as part of each light assembly. The courtesy light circuit is independent of the aircraft battery switch; therefore, the lights can be operated regardless of the position of the battery switch. Unless the engines are running, the courtesy lights should not be left on for extended time periods, as battery depletion could result.

An optional wing tip/recognition light system consists of 2 lights (one in each wing tip) and is operated by a switch mounted adjacent to existing switches on the pilot's side of the instrument panel.

S/N 34-8133001 THRU 34-8233205

Approximately 2000 RPM or more is required to obtain full alternator output of 65 amperes. It is normal to have zero output at idle RPM. This is due to the reduced drive ratio from the engine. Dual ammeters and the ALT annunciator light provide a means of monitoring the electrical system operation. The two ammeters (load meters) indicate the output of the alternators. Should an ammeter indicate a load much higher than the known consumption of the electrical equipment in use, an alternator malfunction should be suspected and the respective alternator switch turned off. In this event, the remaining alternator's ammeter should show a normal indication after approximately one minute. If both ammeters indicate a load much higher than the known consumption for more than approximately five minutes, an electrical defect other than the alternator system should be suspected because a discharged battery will reduce the alternator load as it approaches the charged conditions. A zero ammeter reading indicates an alternator is not producing current and should be accompanied by illumination of the ALT annunciator light. A single alternator is capable of supporting a continued flight in case of alternator or engine failure in most conditions; however, with deicing equipment and other high loads, care must be exercised to prevent the loads from exceeding the 65 ampere rating and subsequent depletion of the battery. For abnormal and/or emergency operations and procedures refer to Section 3 - Emergency Procedures.

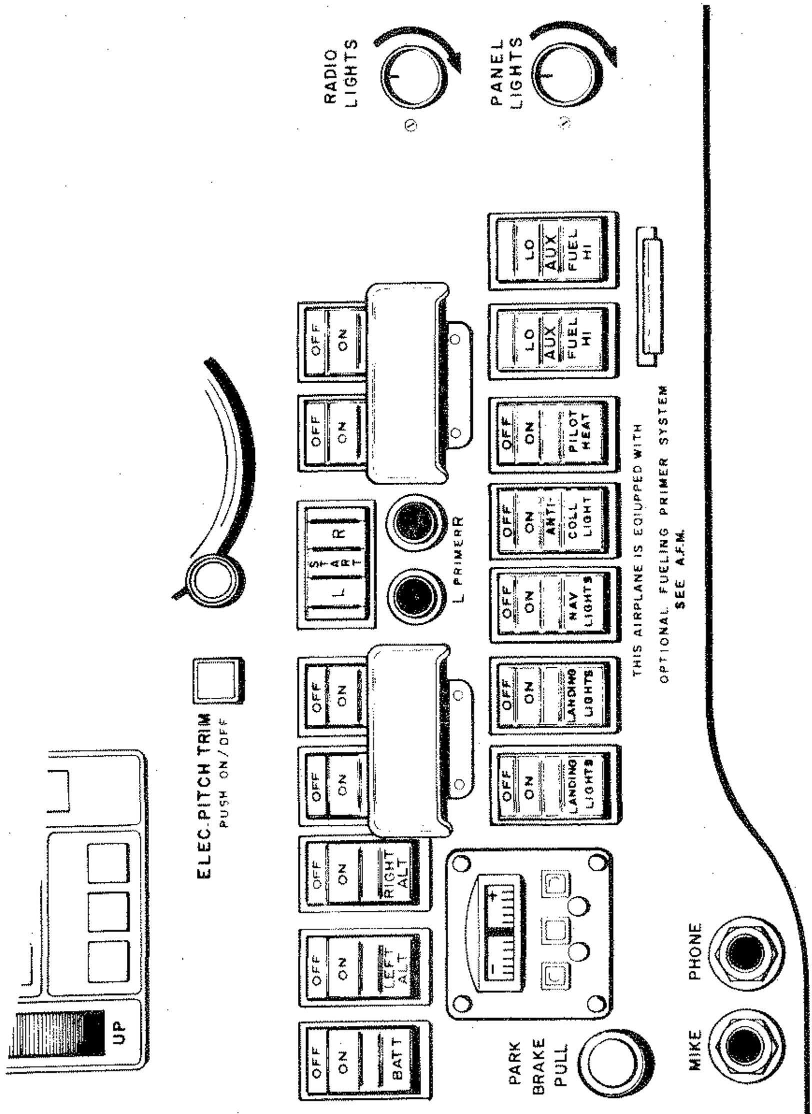
S/N 34-8333001 AND UP

A single ammeter on the instrument panel indicates both battery charging current and alternator output. When the ammeter needle indicates to the left of center, the battery is being discharged; when the needle indicates to the right of center, the battery is being charged. During single-engine operation, this feature can be used to determine how much the electrical load should be reduced. To check the output of each alternator individually, use the press-to-test buttons located on either side of the ammeter. The left button, when depressed, will cause the ammeter to indicate left alternator output, and the right button, when depressed, will indicate right alternator output. These buttons are the momentary type, and indicate alternator output only while depressed.

Approximately 2000 RPM or more is required to obtain full alternator output of 65 amperes. It is normal to have zero output at idle RPM. This is due to the reduced drive ratio from the engine. Ammeter and the ALT annunciator lights provide a means of monitoring the electrical system operation.Should the ammeter indicate a load much higher than the known consumption of the electrical equipment in use, an alternator malfunction should be suspected and the respective alternator switch turned off. In this event, the remaining alternator should show a normal indication on the ammeter after approximately one minute. If both alternators indicate a load much higher than the known consumption for more than approximately five minutes, an electrical defect other than the alternator system should be suspected because a discharged battery will reduce the alternator load as it approaches the charged conditions. A zero ammeter reading indicates an alternator is not producing current and should be accompanied by illumination of the ALT annunciator light. A single alternator is capable of supporting a continued flight in case of alternator or engine failure in most conditions; however, with deicing equipment and other high loads, care must be exercised to prevent the loads from exceeding the 65 ampere rating and subsequent depletion of the battery. For abnormal and/or emergency operations and procedures refer to Section 3 - Emergency Procedures.

CAUTION

Do not use cigar lighter receptacles as power sources for any devices other than the cigar lighters supplied with the airplane. Any other device plugged into these receptacles may be damaged.



SWITCH PANEL - WITH PRIMER SYSTEM
Figure 7-15

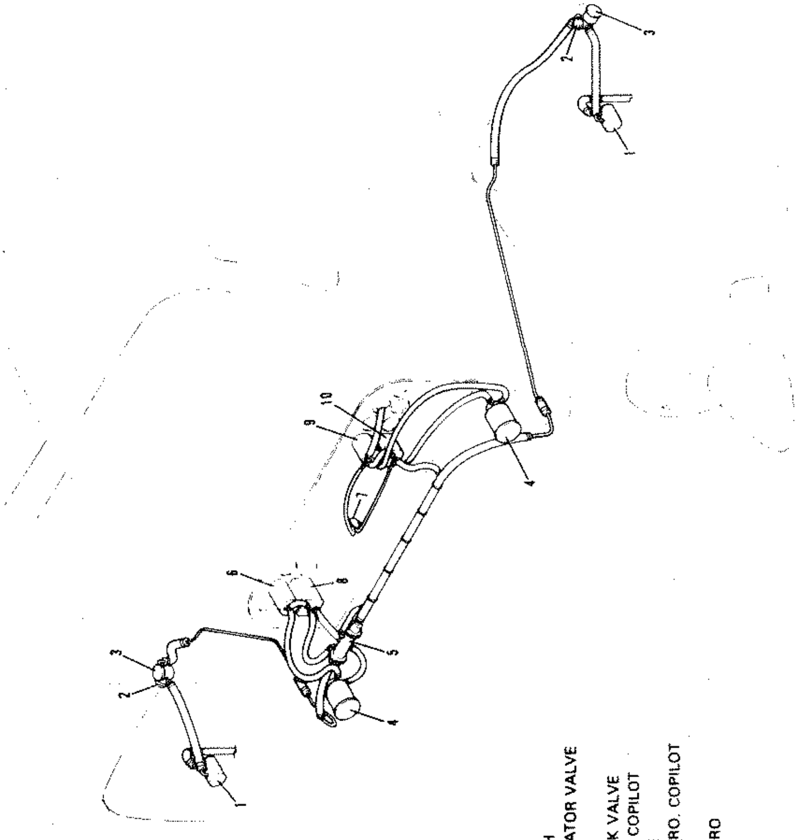
7.19 VACUUM SYSTEM

The vacuum system operates the air driven gyro instruments. The vacuum system (Figure 7-17) consists of a vacuum pump on each engine, plus plumbing and regulating equipment.

The vacuum pumps are dry type pumps, which eliminates the need for an air/oil separator and its plumbing. A shear drive protects the engine from damage. If the drive shears the gyros will become inoperative.

The vacuum gauge, mounted in the center of the instrument panel below the radios (refer to Figure 7-21), provides valuable information to the pilot about the operation of the vacuum system. A decrease in pressure in a system that has remained constant over an extended period, may indicate a dirty filter, dirty screens, possibly a sticking vacuum regulator or leak in system (low vacuum indicator lights are provided in the annunciator panel). Zero pressure would indicate a sheared pump drive, defective pump, possibly a defective gauge or collapsed line. In the event of any gauge variation from the norm, the pilot should have a mechanic check the system to prevent possible damage to the system components or eventual failure of the system.

A vacuum regulator is provided in the system to protect the gyros. The valve is set so the normal vacuum reads 4.8 to 5.1 inches of mercury, a setting which provides sufficient vacuum to operate all the gyros at their rated RPM. Higher settings will damage the gyros and with a low setting the gyros will be unreliable. The regulator is located behind the instrument panel.



VACUUM SYSTEM
Figure 7-17

7.21 PITOT STATIC SYSTEM

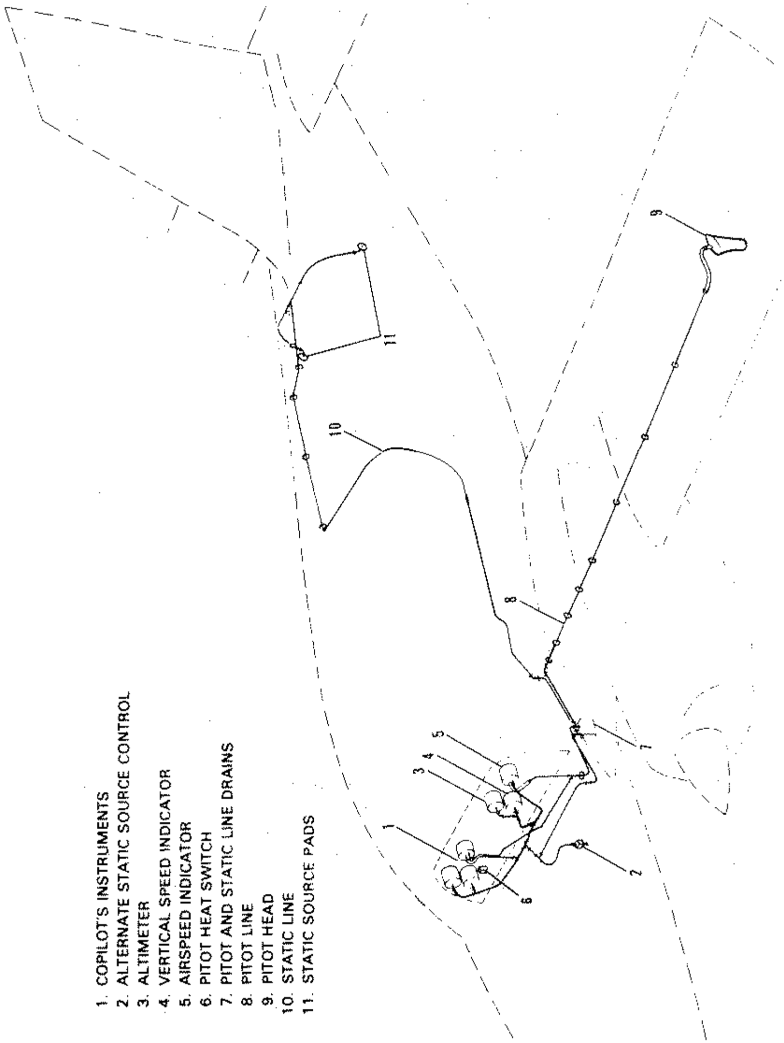
Pitot pressure for the airspeed indicator is sensed by an aluminum pitot head installed on the bottom of the left wing and carried through lines within the wing and fuselage to the gauge on the instrument panel (refer to Figure 7-19). Static pressure for the altimeter, vertical speed and airspeed indicators is sensed by two static source pads, one on each side of the rear fuselage forward of the stabilator. They connect to a single line leading to the instruments. The dual pickups balance out differences in static pressure caused by side slips or skids.

An alternate static source control valve is located below the instrument panel to the right of the control quadrant. When the valve is set to the alternate position, the altimeter, vertical speed indicator and airspeed indicator will be using cabin air for static pressure. During alternate static source operation, these instruments may give slightly different readings, depending on conditions within the cabin. Airspeed, setting of heating and ventilating controls, or the position of the storm window can influence cabin air pressure. The pilot can determine the effects of the alternate static source on instrument readings by switching from standard to alternate sources at different airspeeds and heating and ventilating configurations (including open storm window below 129 KIAS).

If one or more of the pitot static instruments malfunction, the system should be checked for dirt, leaks, or moisture. The pitot and static lines may be drained through separate drains located on the side panel next to the pilot's seat.

The holes in the sensors for pitot and static pressure must be fully open and free from blockage. Blocked sensor holes will give erratic or zero readings on the instruments.

A heated pitot head, which alleviates problems with icing and heavy rain, is available as optional equipment. Static source pads have been demonstrated to be non-icing; however, in the event icing does occur, selecting the alternate static source will alleviate the problem.



PITOT STATIC SYSTEM
Figure 7-19

7.23 INSTRUMENT PANEL

Flight instruments are grouped in the upper instrument panel (Figure 7-21), engine instruments are to the left of the radios. The autopilot is to the left of pilots control wheel. The circuit breaker panel is on the lower right instrument panel. The left and right engine instruments are stacked by the pilots control wheel shaft.

Radios are mounted in the center of the upper instrument panel. The control quadrant-throttles, propeller and mixture controls are in the center of the lower instrument panel. To the left of the control quadrant is the landing gear selector.

An annunciator panel is located to the upper left of the radios, and incorporates a press-to-test feature. The annunciator panel includes the manifold pressure overboost, oil pressure, gyro vacuum, alternator, auxiliary fuel, gear unsafe, heater overheat and provisions for an optional baggage door ajar and air conditioner door open lights. The illumination of these lights in flight is an indication of a possible system malfunction. The pilot should closely monitor instrument panel gauges to check the condition of a system whose corresponding light on the annunciator panel illuminates. Illumination of the manifold pressure overboost lights indicates manifold pressure at or above the maximum allowable 40 inches Hg. During preflight the operational status of the annunciator panel should be tested by use of the press-to-test button. When the button is depressed all annunciator panel lights should illuminate.

NOTE

> When an engine is feathered, the alternator, gyro air and engine oil pressure annunciator lights will remain illuminated.

Optimum cockpit lighting for night flying is achieved by using a combination of the panel lights and the red overhead flood lights. The panel lights are adjusted by rheostat switches below the pilot's control shaft. The overhead lights are adjusted by rheostat switches adjacent to the lights. A white map light can be selected from either overhead flood light.

Most of the electrical switches are located in the switch panel on the left side of the instrument panel. A radio power switch is located near the top of the instrument panel between the radio stacks. It controls the power to all radios through the aircraft battery switch. The radio power switch has an ON and OFF position.

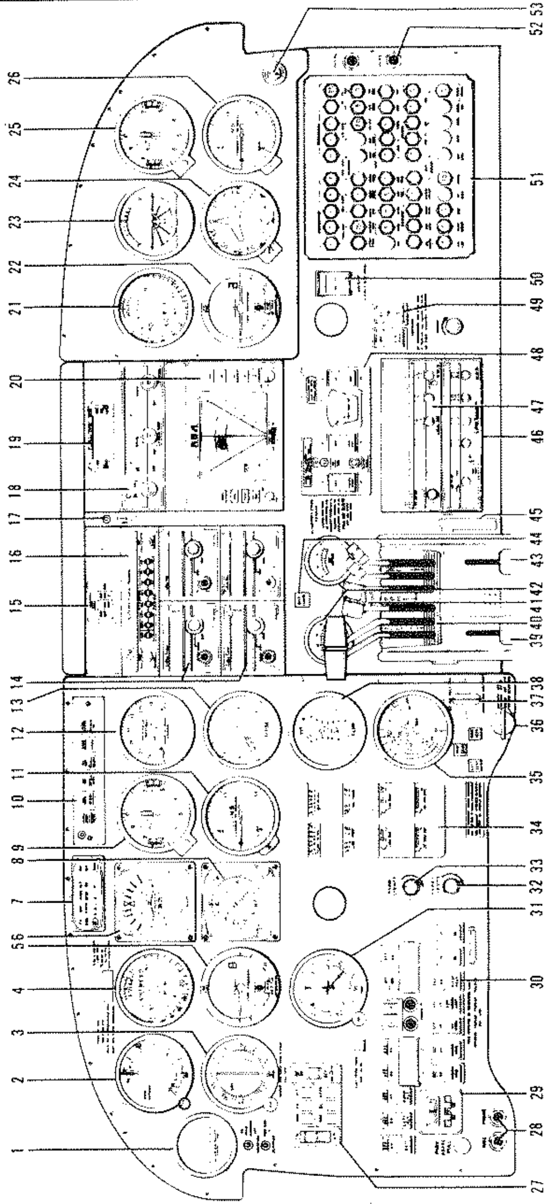
An optional ground clearance energy saver system is available to provide direct power to Comm #1 without turning on the master switch. An internally lit pushbutton switch, located on the instrument panel, provides annunciation for engagement of the system. When the button is engaged direct aircraft battery power is applied to Comm #1, audio amplifier (speaker) and radio accessories. The switch must be turned off or depletion of battery could result.

An "Auxiliary Avionics Bus Switch" is located on the instrument panel to the right of the copilot control wheel shaft. The switch is provided to give auxiliary power to the avionics bus in the event of a radio master switch circuit failure.

The manifold pressure lines have drain valves located behind and below the dual manifold pressure gauge at the bottom of the instrument panel. This allows any moisture which may have collected from condensation to be pulled into the engines. This is accomplished by depressing the two valves for 5 seconds while operating the engines at 1000 RPM.

NOTE

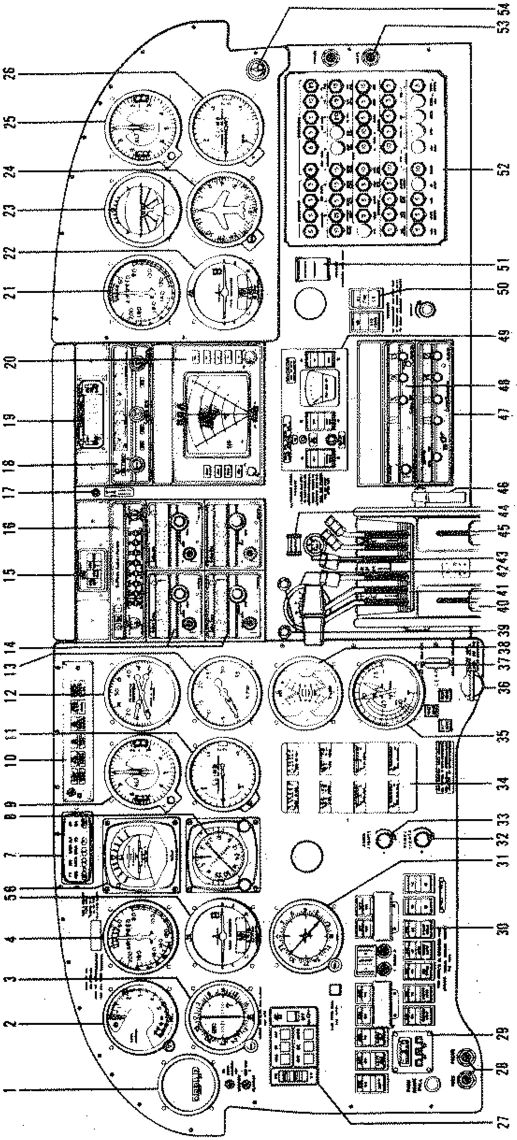
Do not depress the valves when manifold pressure exceeds 25 inches Hg.



TYPICAL INSTRUMENT PANEL
S/N 34-8133001 THRU 34-8233205
Figure 7-21

1. HOURMETER
2. RADAR ALTIMETER
3. NAV INDICATOR
4. AIRSPEED INDICATOR
5. TURN AND BANK INDICATOR
6. ATTITUDE GYRO
7. AUTOPILOT ANNUNCIATOR PANEL
8. DIRECTIONAL GYRO
9. ALTIMETER
10. ANNUNCIATOR PANEL
11. VERTICAL SPEED INDICATOR
12. DUAL MANIFOLD PRESSURE GAUGE
13. DUAL TACHOMETER
14. AVIONICS
15. MODE SELECTOR
16. AUDIO/MARKER PANEL
17. RADIO MASTER SWITCH
18. R-NAV
19. DME
20. RADAR
21. AIRSPEED INDICATOR, COPILOT
22. TURN AND BANK INDICATOR
23. ATTITUDE GYRO, COPILOT
24. DIRECTIONAL GYRO, COPILOT
25. ALTIMETER, COPILOT
26. VERTICAL SPEED INDICATOR
27. AUTOPILOT CONTROL PANEL
28. PILOT'S MIKE AND PHONE JACKS
29. SLAVING METER
30. SWITCH PANEL
31. ADF INDICATOR
32. PANEL LIGHTS
33. RADIO LIGHTS
34. ENGINE GAUGES
35. DUAL FUEL FLOW GAUGE
36. EMERGENCY GEAR EXTENDER
37. LANDING GEAR SELECTOR
38. DUAL EGT GAUGE
39. LEFT ENGINE ALTERNATE AIR CONTROL LEVER
40. CONTROL LEVERS
41. VACUUM GAUGE
42. AMMETERS
43. RIGHT ENGINE ALTERNATE AIR CONTROL LEVER
44. GROUND CLEARANCE SWITCH
45. CONTROL FRICTION LOCK
46. TRANSPONDER
47. ADF
48. PNEUMATIC DE-ICE CONTROLS
49. ECS CONTROL SWITCHES
50. AVIONICS EMERGENCY BUS SWITCH
51. CIRCUIT BREAKER PANEL
52. COPILOT'S MIKE AND PHONE JACKS
53. CIGAR LIGHTER

TYPICAL INSTRUMENT PANEL (cont)
S/N 34-8133001 THRU 34-8233205 (cont)
Figure 7-21 (cont)



TYPICAL INSTRUMENT PANEL
S/N 34-8333001 AND UP
Figure 7-22

1. HOURMETER
2. RADAR ALTIMETER
3. NAV INDICATOR
4. AIRSPEED INDICATOR
5. TURN AND BANK INDICATOR
6. ATTITUDE GYRO
7. AUTOPILOT ANNUNCIATOR PANEL
8. DIRECTIONAL GYRO
9. ALTIMETER
10. ANNUNCIATOR PANEL
11. VERTICAL SPEED INDICATOR
12. DUAL MANIFOLD PRESSURE GAUGE
13. DUAL TACHOMETER
14. AVIONICS
15. MODE SELECTOR
16. AUDIO/MARKER PANEL
17. RADIO MASTER SWITCH
18. R-NAV
19. DME
20. RADAR
21. AIRSPEED INDICATOR, COPILOT
22. TURN AND BANK INDICATOR
23. ATTITUDE GYRO, COPILOT
24. DIRECTIONAL GYRO, COPILOT
25. ALTIMETER, COPILOT
26. VERTICAL SPEED INDICATOR
27. AUTOPILOT CONTROL PANEL
28. PILOT'S MIKE AND PHONE JACKS
29. SLAVING METER
30. SWITCH PANEL
31. ADF INDICATOR
32. PANEL LIGHTS
33. RADIO LIGHTS
34. ENGINE GAUGES
35. DUAL FUEL FLOW GAUGE
36. EMERGENCY GEAR EXTENDER
37. LANDING GEAR SELECTOR
38. DUAL EGT GAUGE
39. AMMETER PRESS-TO-TEST BUTTONS
40. LEFT ENGINE ALTERNATE AIR CONTROL LEVER
41. CONTROL LEVERS
42. AMMETER
43. VACUUM GAUGE
44. GROUND CLEARANCE SWITCH
45. RIGHT ENGINE ALTERNATE AIR CONTROL LEVER
46. CONTROL FRICTION LOCK
47. TRANSPONDER
48. ADF
49. PNEUMATIC DE-ICE CONTROLS
50. ECS CONTROL SWITCHES
51. AVIONICS EMERGENCY BUS SWITCH
52. CIRCUIT BREAKER PANEL
53. COPILOT'S MIKE AND PHONE JACKS
54. CIGAR LIGHTER

TYPICAL INSTRUMENT PANEL (cont)
S/N 34-8333001 AND UP (cont)
Figure 7-22 (cont)

7.25 HEATING, VENTILATING AND DEFROSTING SYSTEM

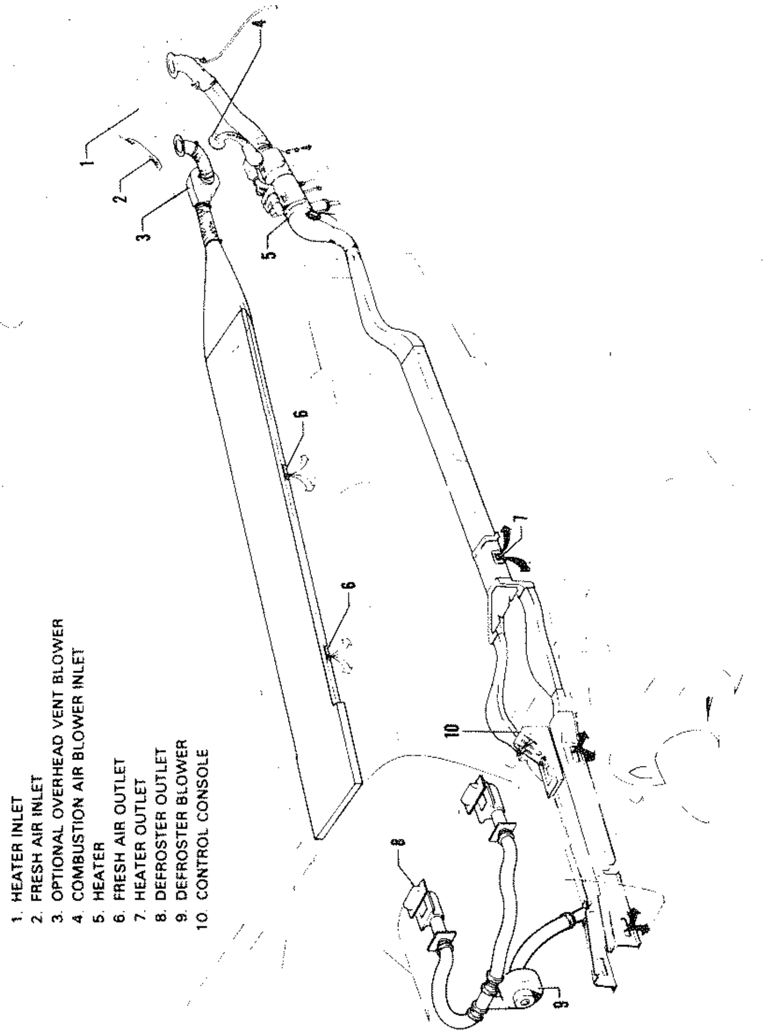
Heated air for cabin heat and windshield defrosting is provided by a Janitrol combustion heater located in the aft fuselage behind the cabin baggage compartment close-out panel (refer to Figure 7-23). Air from the heater is ducted forward along the cabin floor to outlets at each seat and to the windshield area.

Operation of the combustion heater is controlled by a three-position switch located on the control console (Figure 7-25) between the front seats and labeled FAN, OFF and HEATER. Airflow and temperature are regulated by the two levers on the console. The right-hand lever regulates air intake and the left-hand lever regulates cabin temperature. Cabin comfort can be maintained as desired through various combinations of lever positions. Passengers have secondary control over heat output by individually adjustable outlets at each seat location.

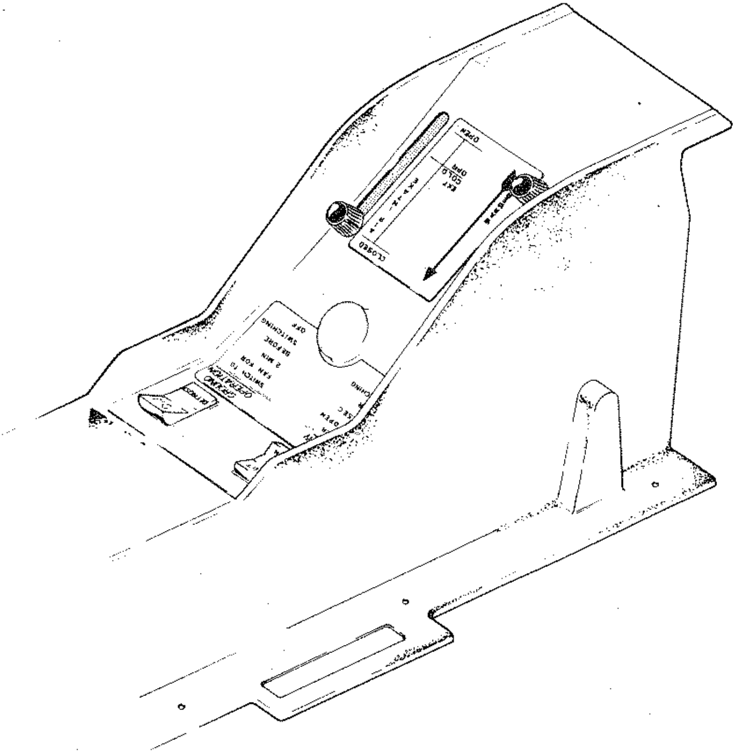
For cabin heat, the air intake lever on the heater control console must be partially or fully open and the three-position switch set to the HEATER position. This simultaneously starts fuel flow and ignites the heater; and, during ground operation, it also activates the ventilation blower which is an integral part of the combustion heater. With instant starting and no need for priming, heat should be felt within a few seconds. When cabin air reaches the temperature selected on the cabin temperature lever, ignition of the heater cycles automatically to maintain the selected temperature. Two safety switches activated by the intake valve and located aft of the heater unit prevent both fan and heater operation when the air intake lever is in the closed position. A micro switch, which actuates when the landing gear is retracted, turns off the ventilation blower so that in flight the cabin air is circulated by ram air pressure only.

When the three-position switch is in the FAN position during ground operation, the ventilation fan blows fresh air through the heater ductwork for cabin ventilation and windshield defogging when heat is not desired. When the heater controls are used either for cabin heat or for ventilation, air is automatically ducted to the windshield area for defrosting.

The flow of defroster air to the windshield area can be increased by the activation of a defroster fan. The fan is controlled by a defroster switch located on the control console between the two front seats.



CABIN HEATING, VENTILATING AND DEFROSTING SYSTEM
Figure 7-23



HEATING, VENTILATING AND DEFROSTING CONTROL CONSOLE
Figure 7-25

To introduce fresh, unheated air into the cabin during flight, the air intake should be open and the heater off. Ram air enters the system and can be individually regulated at each floor outlet. Overhead outlets also supply fresh air for cabin ventilation. The occupant of each seat can manually adjust an outlet in the ceiling to regulate the flow of fresh air to that seat area. An optional fresh air blower may be installed in the overhead ventilation system to provide additional fresh air flow during ground operation.

An overheat switch located in the heater unit acts as a safety device to render the heater inoperative if a malfunction should occur. Should the switch deactivate the heater, the OVERHEAT light on the annunciator panel will illuminate. The overheat switch is located on the forward outboard end of the heater vent jacket. The red reset button on the heater shroud can be reached through the bulkhead access panel in the aft cabin close-out panel.

To prevent activation of the overheat switch upon normal heater shutdown during ground operation, turn the three-position switch to FAN for two minutes with the air intake lever in the open position before turning the switch to OFF. During flight, leave the air intake lever open for a minimum of fifteen seconds after turning the switch to OFF.

The combustion heater uses fuel from the airplane fuel system. An electric fuel pump draws fuel from the left tank at a rate of approximately one-half gallon per hour. Fuel used for heater operation should be considered when planning for a flight.

7.27 CABIN FEATURES

The front seats are adjustable fore and aft. Each seat reclines and is provided with an armrest. The center and rear seats are easily removed to provide additional cargo space.

NOTE

> To remove the center seats, retainers securing the back legs of the seats must be unlocked. Releasing the retainers is accomplished by depressing the plunger behind each rear leg. Any time the seats are installed in the airplane, the retainers should be in the locked position. To remove the rear seats, depress the plunger behind each front leg and slide seat to rear.

An optional jump seat, which can be mounted between the two center seats, gives the Seneca III seven-place capabilities.

Shoulder harnesses with inertia reels are standard equipment for the front seats and are offered as optional equipment for the third, fourth, fifth and sixth seats but not for the seventh seat. The inertia reel should be checked by tugging sharply on the strap. The reel will lock in place under this test and prevent the strap from extending. Under normal movement, the strap will extend and retract as required.

On earlier aircraft provided with a single strap adjustable shoulder harness for each front seat the shoulder strap is routed over the shoulder adjacent to the windows and attached to the lap belt in the general area of the person's inboard hip. Adjust this fixed strap so that all controls are accessible while maintaining adequate restraint for the occupant.

Shoulder harnesses shall be worn during takeoff and landing. Shoulder harnesses should be worn during an emergency situation.

Standard cabin features include a pilot's storm window, ashtrays, map pockets, coat hooks and assist straps, a cigar lighter, sun visors, and pockets on the front and center seat backs. Among the options which may be added to suit individual needs are headrests, a fire extinguisher, and a special cabin sound-proofing package.

An optional club seating interior is also available. In the club seating interior the center seats face aft. These seats are equipped with lap belts only. Removal of the seats is accomplished by removing the two bolts holding the aft attach points and sliding the seat aft.

An optional refreshment console is located between the center seats. It is removed in a manner identical to the removal of the center seats.

An optional oxygen system is located between the center seats. It is strapped to the jump seat in the standard seating arrangement. In the club seating arrangement it utilizes the same attach points as the refreshment console.

An optional cabin work table, serving the two seats on the right side of the passenger cabin, is offered to the club seating arrangement. The table must be stowed during takeoff and landing. If the table is to be used, it should be set up after a level cruise is established.

To remove the cabin work table from the aft baggage compartment, unlock the stud located on the bottom of the close-out bulkhead. Loosen the white tie-down strap and remove the table from the mounting brackets by lifting the table two inches straight up until it clears the mounting brackets. Do not twist the table while it is in the brackets.

To install the cabin work table during flight, hold the table in place and tilt the free end of the table upward 30° until the lobed upper knobs on the table supports align with the top holes of the escutcheons located below the right cabin window trim. Hold the upper lobes in place and lower the free end of the table to the level work position. The retaining springs will click when secure.

To stow the cabin work table, remove the table by lifting the free end of the table upward to disengage the bottom lobes of the table supports. Lift until the top support lobes disengage at approximately 30° of tilt and remove the table. Position the table in the stowage area and, with the table work surface facing forward, place the slots in the table support into the receptacle clips mounted on the hat shelf. Make sure the tie-down strap is not behind the table. With the table fully placed in the clips, bring the tie-down strap across the face of the table and lock over the stud located on the bottom of the close-out bulkhead.

7.29 STALL WARNING

An approaching stall is indicated by a stall warning indicator which is activated between five and ten knots above stall speed. Mild airframe buffeting and gentle pitching may also precede the stall. Stall speeds are shown on a graph in the Performance Charts Section. The stall warning indicator consists of a continuous sounding horn located behind the instrument panel. The stall warning horn has a different sound from that of the gear warning horn which has a 90 cycles per minute beeping sound. The stall warning indicator is activated by two lift detectors on the leading edge of the left wing, outboard of the engine nacelle. The inboard detector activates the indicator when the flaps are in the 25 and 40 degree positions, the outboard when the flaps are in other positions.

A squat switch in the stall warning system does not allow the units to be activated on the ground.

7.31 BAGGAGE AREA

There are two separate baggage compartments. One, the nose section baggage compartment, is accessible through a baggage door on the left side of the nose section. It has a maximum weight capacity of 100 pounds. The cabin baggage compartment, located aft of seats five and six has a weight capacity of 100 pounds. This compartment is loaded and unloaded through the rear cabin door, and it is accessible during flight. Tie-down straps are provided and should be used at all times. A cargo loading door, installed aft of the rear door, facilitates the loading of bulky items. All cargo, baggage compartment and passenger doors use the same key.

A nose section baggage compartment light* illuminates automatically whenever the baggage door is opened. The baggage compartment light is independent of the aircraft battery switch; therefore, when the baggage door is opened, the light will illuminate regardless of the position of the battery switch. When the baggage compartment light option is installed, the baggage door should not be left open or ajar for extended time periods as battery depletion could result.

An optional forward baggage door adjar annunciator system is available, which senses the baggage door latch pin position. Failure to latch the forward baggage door will illuminate an amber light on the pilot's annunciator panel. The annunciator, when illuminated, is "Baggage Door" advising the pilot of this condition.

NOTE

> It is the pilot's responsibility to be sure when baggage is loaded that the airplane C.G. falls within the allowable C.G. range. (See Weight and Balance Section.)

7.33 FINISH

All exterior surfaces are finished with acrylic lacquer. To keep the finish attractive, economy size spray cans of touch-up paint are available from Piper Dealers.

An optional polyurethane finish is available.

*Optional equipment

7.35 PIPER EXTERNAL POWER*

An optional starting installation known as Piper External Power (PEP) allows the airplane engine to be started from an external battery without the necessity of gaining access to the airplane battery. The cable from the external battery can be attached to a receptacle under the right side of the nose section of the fuselage. Instructions on a placard located on the cover of the receptacle should be followed when starting with external power. For instructions on the use of the PEP, refer to Starting Engines - Section 4.

7.37 EMERGENCY LOCATOR TRANSMITTER*

The Emergency Locator Transmitter (ELT) is located in the aft portion of the fuselage just below the stabilator leading edge and is accessible through a plate on the right side of the fuselage. This plate is attached with slotted-head nylon screws for ease of removal: these screws may be readily removed with a variety of common items such as a dime, key, knife blade, etc. If there are no tools available in an emergency, the screw heads may be broken off by any means. The ELT is an emergency locator transmitter which meets the requirements of FAR 91.52.

On the ELT unit itself is a three position switch placarded ON, OFF and ARM. The ARM position sets the ELT so that it will transmit after impact and will continue to transmit until its battery is drained. The ARM position is selected when the ELT is installed in the airplane and it should remain in that position.

After a forced landing, and assistance is desired, verify the operation of the ELT by tuning a radio receiver to 121.50 MHz. If the ELT transmission can be heard it is functioning properly. If there is no ELT transmission, remove the ELT access plate in the tail cone and place the ELT selector switch in the ON position.

After verification that the ELT is transmitting, turn off monitoring receiver to conserve the battery. If radio communication is attempted, place the ELT selector switch in the OFF position until the communication is completed.

*Optional equipment

If required, the ELT may be removed from the airplane and used as a portable unit. To use the ELT as a portable unit in an emergency, remove the cover and unlatch the unit from its mounting base. The antenna cable is disconnected by a left quarter-turn of the knurled nut and a pull. A sharp tug on the two small wires will break them loose. Deploy the self-contained antenna by pulling the plastic tab marked "PULL FULLY TO EXTEND ANTENNA." Move the switch to ON to activate the transmitter.

In the event the transmitter is activated by an impact, it can only be turned off by moving the switch on the ELT unit to OFF. Normal operation can then be restored by pressing the small clear plastic reset button located on the top of the front face of the ELT and then moving the switch to ARM.

A pilot's remote switch located on the left side panel is provided to allow the transmitter to be turned on from inside the cabin. The pilot's remote switch is placarded ON and ARMED. The switch is normally in the ARMED position. Moving the switch to ON will activate the transmitter. Moving the switch back to the ARMED position will turn off the transmitter only if the impact switch has not been activated.

The ELT should be checked to make certain the unit has not been activated during the ground check. Check by selecting 121.50 MHz on an operating receiver. If there is an oscillating chirping sound, the ELT may have been activated and should be turned off immediately. This requires removal of the access cover and moving the switch to OFF, then press the reset button and return the switch to ARM. Recheck with the receiver to ascertain the transmitter is silent.

A battery replacement date is marked on the transmitter to comply with FAA regulations, the battery must be replaced on or before this date. The battery must also be replaced if the transmitter has been used in an emergency situation or if the accumulated test time exceeds one hour, or if the unit has been inadvertently activated for an undetermined time period.

NOTE

> If for any reason a test transmission is necessary, the test transmission should be conducted only in the first five minutes of any hour and limited to three audio sweeps. If the tests must be made at any other time, the tests should be coordinated with the nearest FAA tower or flight service station.

7.39 PIPER CONTROL WHEEL CLOCK

The time and date can be set by the operation of the reset (RST) button while in the clock mode.

The month is set by pressing the reset (RST) button once, this will cause the date to appear with the month flashing. Pressing the start/stop (ST-SP) button advances the months at one per second or one per push, until the right month appears. To set the date, press the reset (RST) button once again causing the date to flash, then press the start/stop (ST-SP) button to advance to the correct date.

To set the correct hour, press the RST button two times causing the hours digits to flash. Press the ST-SP button to advance to the correct hour.

The minutes can now be set by pressing the RST button once again and causing the minutes digits to flash. Set the minutes to the next minute to come up at the zero seconds time mark and depress the RST button to hold the time displayed. At the time mark, press the ST-SP button momentarily to begin time counting at the exact second. If the minutes are not advanced when they are flashing in the set mode, pressing the RST button will return the clock to the normal timekeeping mode without altering the minutes timing. This feature is useful when changing time zones, when only the hours are to be changed.

The calender function will automatically advance the date correctly according to the four year perpetual calendar. One day must be added manually on February 29 on leap year. The date advances correctly at midnite.

To display a test function, press both the RST and ST-SP buttons at the same time.

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SECTION 8

AIRPLANE HANDLING, SERVICING AND MAINTENANCE

8.1 GENERAL

This section provides general guidelines relating to the handling, servicing and maintenance of the Seneca III.

Every owner should stay in close contact with his Piper dealer or distributor and Authorized Piper Service Center to obtain the latest information pertaining to his aircraft and to avail himself of the Piper Aircraft Service Back-up.

Piper Aircraft Corporation takes a continuing interest in having the owner get the most efficient use from his aircraft and keeping it in the best mechanical condition. Consequently, Piper Aircraft from time to time issues Service Bulletins, Service Letters and Service Spares Letters relating to the aircraft.

Service Bulletins are of special importance and should be complied with promptly. These are sent to the latest registered owners, distributors and dealers. Depending on the nature of the bulletin, material and labor allowances may apply, and will be addressed in the body of the Bulletin.

Service Letters deal with product improvements and service hints pertaining to the aircraft. They are sent to dealers, distributors and occasionally (at the factory's discretion) to the latest registered owners, so they can properly service the aircraft and keep it up to date with the latest changes. Owners should give careful attention to the Service Letter information.

Service Spares Letters offer improved parts, kits and optional equipment which were not available originally and which may be of interest to the owner.

If an owner is not having his aircraft serviced by an Authorized Piper Service Center, he should periodically check with a Piper dealer or distributor to find out the latest information to keep his aircraft up to date.

Piper Aircraft Corporation has a Subscription Service for the Service Bulletins, Service Letters and Service Spares Letters. This service is offered to interested persons such as owners, pilots and mechanics at a nominal fee, and may be obtained through Piper dealers and distributors.

A service manual, parts catalog, and revisions to both, are available from Piper dealers or distributors. Any correspondence regarding the airplane should include the airplane model and serial number to ensure proper response.

8.3 AIRPLANE INSPECTION PERIODS

The Federal Aviation Administration (FAA) occasionally publishes Airworthiness Directives (ADs) that apply to specific groups of aircraft. They are mandatory changes and are to be complied with within a time limit set by the FAA. When an AD is issued, it is sent by the FAA to the latest registered owner of the affected aircraft and also to subscribers of their service. The owner should periodically check with his Piper dealer or A & P mechanic to see whether he has the latest issued AD against his aircraft.

The Owner Service Agreement which the owner receives upon delivery of the aircraft should be kept in the aircraft at all times. This identifies the owner to authorized Piper dealers and entitles the owner to receive service in accordance with the regular service agreement terms. This agreement also entitles the transient owner full warranty by any Piper dealer in the world.

One hundred hour inspections are required by law if the aircraft is used commercially. Otherwise this inspection is left to the discretion of the owner. This inspection is a complete check of the aircraft and its systems, and should be accomplished by a Piper Authorized Service Center or by a qualified aircraft and power plant mechanic who owns or works for a reputable repair shop. The inspection is listed, in detail, in the inspection report of the appropriate Service Manual.

An annual inspection is required once a year to keep the Airworthiness Certificate in effect. It is the same as a 100-hour inspection except that it must be signed by an Inspection Authorized (IA) mechanic or a General Aviation District Office (GADO) representative. This inspection is required whether the aircraft is operated commercially or for pleasure.

A Progressive Maintenance program is approved by the FAA and is available to the owner. It involves routine and detailed inspections at 50-hour intervals. The purpose of the program is to allow maximum utilization of the aircraft, to reduce maintenance inspection cost and to maintain a maximum standard of continuous airworthiness. Complete details are available from Piper dealers.

A spectographic analysis of the oil is available from several sources. This system, if used intelligently, provides a good check of the internal condition of the engine. For this system to be accurate, oil samples must be sent in at regular intervals, and induction air filters must be cleaned or changed regularly.

8.5 PREVENTIVE MAINTENANCE

The holder of a Pilot Certificate issued under FAR Part 61 may perform certain preventive maintenance described in FAR Part 43. This maintenance may be performed only on an aircraft which the pilot owns or operates and which is not used to carry persons or property for hire, except as provided in applicable FAR's. Although such maintenance is allowed by law, each individual should make a self-analysis as to whether he has the ability to perform the work.

All other maintenance required on the airplane should be accomplished by appropriately licensed personnel.

If maintenance is accomplished, an entry must be made in the appropriate logbook. The entry should contain:

(a) The date the work was accomplished.
(b) Description of the work.
(c) Number of hours on the aircraft.
(d) The certificate number of pilot performing the work.
(e) Signature of the individual doing the work.

8.7 AIRPLANE ALTERATIONS

If the owner desires to have his aircraft modified, he must obtain FAA approval for the alteration. Major alterations accomplished in accordance with Advisory Circular 43.13-2, when performed by an A & P mechanic, may be approved by the local FAA office. Major alterations to the basic airframe or systems not covered by AC 43.13-2 require a Supplemental Type Certificate.

The owner or pilot is required to ascertain that the following Aircraft Papers are in order and in the aircraft.

(a) To be displayed in the aircraft at all times:
- (1) Aircraft Airworthiness Certificate Form FAA-8100-2.
- (2) Aircraft Registration Certificate Form FAA-8050-3.
- (3) Aircraft Radio Station License if transmitters are installed.

(b) To be carried in the aircraft at all times:
- (1) Pilot's Operating Handbook.
- (2) Weight and Balance data plus a copy of the latest Repair and Alteration Form FAA-337, if applicable.
- (3) Aircraft equipment list.

Although the aircraft and engine logbooks are not required to be in the aircraft, they should be made available upon request. Logbooks should be complete and up to date. Good records will reduce maintenance cost by giving the mechanic information about what has or has not been accomplished.

8.9 GROUND HANDLING

(a) Towing

The airplane may be moved on the ground by the use of the nose wheel steering bar that is stowed in the baggage compartment or by power equipment that will not damage or excessively strain the nose gear steering assembly.

CAUTIONS

When towing with power equipment, do not turn the nose gear beyond its steering radius in either direction, as this will result in damage to the nose gear and steering mechanism.

Do not tow the airplane when the controls are secured.

In the event towing lines are necessary, ropes should be attached to both main gear struts as high up on the tubes as possible. Lines should be long enough to clear the nose and / or tail by not less than fifteen feet, and a qualified person should ride in the pilot's seat to maintain control by use of the brakes.

(b) Taxiing

Before attempting to taxi the airplane, ground personnel should be instructed and approved by a qualified person authorized by the owner. Engine starting and shut-down procedures as well as taxi techniques should be covered. When it is ascertained that the propeller back blast and taxi areas are clear, power should be applied to start the taxi roll, and the following checks should be performed:

(1) Taxi a few feet forward and apply the brakes to determine their effectiveness.
(2) Taxi with the propeller set in low pitch, high RPM setting.
(3) While taxiing, make slight turns to ascertain the effectiveness of the steering.
(4) Observe wing clearance when taxiing near buildings or other stationary objects. If possible, station an observer outside the airplane.
(5) When taxiing over uneven ground, avoid holes and ruts.

(6) Do not operate the engine at high RPM when running up or taxiing over ground containing loose stones, gravel, or any loose material that may cause damage to the propeller blades.

(c) Parking

When parking the airplane, be sure that it is sufficiently protected from adverse weather conditions and that it presents no danger to other aircraft. When parking the airplane for any length of time or overnight, it is suggested that it be moored securely.

(1) To park the airplane, head it into the wind if possible.
(2) The parking brake knob is located on the lower left of the instrument panel. To set the parking brake, first depress and hold the toe brake pedals and then pull out the parking brake knob. To release the parking brake, first depress and hold the toe brake pedals and then push in on the parking brake knob.

WARNING

No braking will occur if knob is pulled prior to brake application.

CAUTION

Care should be taken when setting brakes that are overheated or during cold weather when accumulated moisture may freeze a brake.

(3) Aileron and stabilator controls should be secured with the front seat belt and chocks used to properly block the wheels.

(d) Mooring

The airplane should be moored for immovability, security and protection. The following procedures should be used for the proper mooring of the airplane:

(1) Head the airplane into the wind if possible.
(2) Retract the flaps.
(3) Immobilize the ailerons and stabilator by looping the seat belt through the control wheel and pulling it snug.
(4) Block the wheels.

(5) Secure tie-down ropes to the wing tie-down rings and to the tail skid at approximately 45 degree angles to the ground. When using rope of non-synthetic material, leave sufficient slack to avoid damage to the airplane should the ropes contract.

CAUTION

Use bowline knots, square knots or locked slip knots. Do not use plain slip knots.

NOTE

Additional preparations for high winds include using tie-down ropes from the landing gear forks and securing the rudder.

(6) Install a pitot head cover if available. Be sure to remove the pitot head cover before flight.
(7) Cabin and baggage doors should be locked when the airplane is unattended.

8.11 ENGINE INDUCTION AIR FILTERS

(a) Removing Induction Air Filter

(1) Remove the upper cowling to gain access to the air filter box.
(2) Turn the four studs and remove the air filter box cover.
(3) Lift the air filter from the filter box.

(b) Cleaning Induction Air Filters

The induction air filters must be cleaned at least once every 50 hours, and more often, even daily, when operating in dusty conditions. Extra filters are inexpensive, and a spare should be kept on hand for use as a rapid replacement.

To clean the filter:
(1) Tap filter gently to remove dirt particles. Do not use compressed air or cleaning solvents.

(2) Inspect filter. If paper element is torn or ruptured or gasket is damaged, the filter should be replaced. The usable life of the filter should be restricted to one year or 500 hours, whichever comes first.

(c) Installation of induction Air Filters

After cleaning, place filter in air box and install cover. Secure cover by turning studs. Replace cowl.

8.13 BRAKE SERVICE

The brake system is filled with MIL-H-5606 (petroleum base) hydraulic brake fluid. This should be checked periodically or at every 50-hour inspection and replenished when necessary. The brake reservoir is located in the forward maintenance area. Remove the four screws and rotate the fiberglass nose cone forward and down. The reservoir is located at the top rear of the compartment. Keep the fluid level at the level marked on the reservoir.

No adjustment of brake clearance is necessary. Refer to the Service Manual for brake lining replacement instructions.

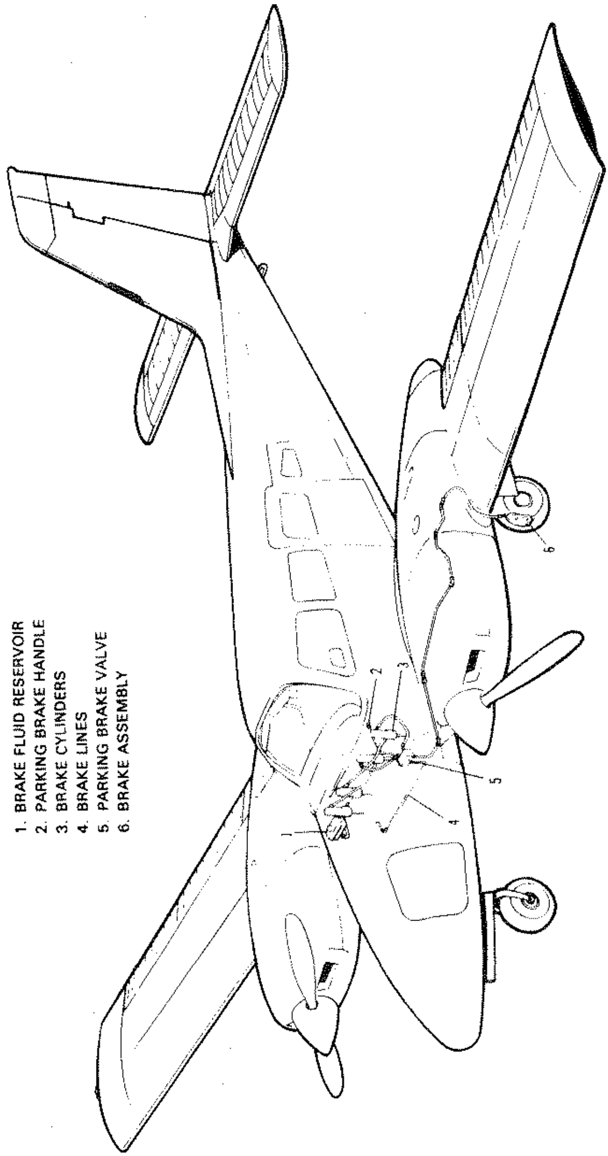
8.15 LANDING GEAR SERVICE

Two jack points are provided for jacking the aircraft for servicing. One is located outboard of each main landing gear. Before jacking, attach a tail support to the tail skid. Approximately 500 pounds of ballast should be placed on the tail support.

CAUTION

Be sure to apply sufficient support ballast; otherwise the airplane may tip forward, and the nose section could be damaged.

Landing gear oleos should be serviced according to instruction on the units. Under normal static load (empty weight of airplane plus full fuel and oil), main oleo struts should be exposed approximately 3.20 inches and the nose oleo strut should be exposed 2.50 inches. Refer to the Service Manual for complete information on servicing oleo struts.



BRAKE SYSTEM
Figure 8-1

8.17 PROPELLER SERVICE

The gas charge in the propeller cylinder should be kept at the pressure specified on the placard located in the spinner cap. The pressure in the cylinder will increase about one-third psi for every degree Fahrenheit increase in temperature. This effect should be considered when checking pressure. The charge maintained must be accurate and free of excessive moisture since moisture may freeze the piston during cold weather. Dry nitrogen gas is recommended.

CHAMBER PRESSURE REQUIREMENTS WITH TEMPERATURE FOR HARTZELL COUNTERWEIGHT TYPE PROPELLERS

FOR PROPELLER HUBS: BHC-C2YF-2CKUF AND BHC-C2YF-2CLKUF	
Temp. °F	Pressure (PSI)
70 to 100	22 ± 2
40 to 70	17 ± 2
0 to 40	14 ± 2
-30 to 0	9 ± 2

NOTE: Do not check pressure or charge with propeller in feather position.

The spinner and backing plate should be cleaned and inspected for cracks frequently. Before each flight the propeller should be inspected for nicks, scratches, or corrosion. If found, they should be repaired as soon as possible by a rated mechanic, since a nick or scratch causes an area of increased stress which can lead to serious cracks or the loss of a propeller tip. The back face of the blades should be painted when necessary with flat black paint to retard glare. To prevent corrosion, all surfaces should be cleaned and waxed periodically.

The gas charge in the optional unfeathering accumulators should be maintained at 90 - 100 PSI. It is important to use nitrogen only for this purpose since any moisture in the system may freeze and render it inoperative. Do not check this charge pressure while engine is running.

8.19 OIL REQUIREMENTS

The oil capacity of the Teledyne Continental engines is 8 quarts per engine with a minimum safe quantity of 3 quarts per engine. It is recommended that oil be added if the quantity falls to 6 quarts. It is recommended that engine oil be drained and renewed every 100 hours, or sooner under unfavorable conditions. Full flow cartridge type oil filters should be replaced each 50 hours of operation. The following grades are required for temperatures:

OIL VISCOSITY

	Aviation Grade	S.A.E. No.
Below 40° F	1065	30
Above 40° F	1100	50

8.21 FUEL SYSTEM

(a) Servicing Fuel System

The fuel screens in the strainers require cleaning at 50 hour or 90 day intervals, whichever occurs first. The fuel gascolator strainers are located in the wing between the fuel selector valves and the auxiliary pumps in the nacelles. The fuel injector screen is located in the housing where the fuel inlet line connects to the injector. This screen should be cleaned every 50 hours of operation.

(b) Fuel Requirements

The minimum aviation grade fuel for the Seneca III is 100. Since the use of lower grades can cause serious engine damage in a short period of time, the engine warranty is invalidated by the use of lower octanes.

Whenever 100 or 100LL grade fuel is not available, commercial grade 100/130 should be used. (See Fuel Grade Comparison Chart.) Refer to the latest issue of Continental Service Bulletin "Fuel and Oil Grades."

A summary of current grades as well as the previous fuel designations is shown in the following chart:

FUEL GRADE COMPARISON CHART

Previous Commercial Fuel Grades (ASTM-D910)			Current Commercial Fuel Grades (ASTM-D910-75)			Current Military Fuel Grades (MIL-G-5572F) Amendment No. 3		
Grade	Color	Max. TEL ml U.S. gal.	Grade	Color	Max. TEL ml/U.S. gal.	Grade	Color	Max. TEL ml/U.S. gal.
80/87	red	0.5	80	red	0.5	80/87	red	0.5
91/98	blue	2.0	*100LL	blue	2.0	none	none	none
100/130	green	3.0	100	green	**3.0	100/130	green	**3.0
115/145	purple	4.6	none	none	none	115/145	purple	4.6

* - Grade 100LL fuel in some overseas countries is currently colored green and designated as "100L."
** - Commercial fuel grade 100 and grade 100/130 (both of which are colored green) having TEL content of up to 4 ml/U.S. gallon are approved for use in all engines certificated for use with grade 100/130 fuel.

The operation of the aircraft is approved with an anti-icing additive in the fuel. When an anti-icing additive is used it must meet the specification MIL-I-27686, must be uniformly blended with the fuel while refueling, must not exceed .15% by volume of the refueled quantity, and to ensure its effectiveness should be blended at not less than .10% by volume. One and one half liquid ozs. per ten gallon of fuel would fall within this range. A blender supplied by the additive manufacturer should be used. Except for the information contained in this section, the manufacturer's mixing or blending instructions should be carefully followed.

CAUTIONS

Some fuels have anti-icing additives pre-blended in the fuel at the refinery, so no further blending should be performed.

Fuel additive can not be used as a substitute for preflight draining of the fuel system.

FUEL DRAIN
Figure 8-3

CAUTION

Assure that the additive is directed into the flowing fuel stream. The additive flow should start after and stop before the fuel flow. Do not permit the concentrated additive to come in contact with the aircraft painted surfaces or the interior surfaces of the fuel tanks.

(c) Filling Fuel Tanks

Observe all required precautions for handling gasoline. Fill the fuel tanks to the bottom of the filler neck with 100/130 octane fuel. Each wing holds a maximum of 49 gallons, giving a total of 98 gallons of fuel. With optional fuel tanks installed, the total fuel capacity is increased to 128 gallons.

(d) Draining Fuel Strainer, Sumps and Lines

Each gascolator strainer is provided with a quick drain which should be drained before the first flight of the day and after refueling, to check for fuel contamination. If contamination is found, fuel should be drained until the contamination stops. If contamination persists after draining fuel for a minute, contact a mechanic to check the fuel system.

Each fuel tank is provided with a fuel quick drain to check for contamination. Each tank should be checked for contamination in accordance with the above procedure. Crossfeed drains are located on the bottom of the fuselage inboard of the right flap. The fuel drained at each quick drain should be collected in a transparent container and examined for contamination.

CAUTION

When draining fuel, be sure that no fire hazard exists before starting the engines.

(e) Draining Fuel System

The bulk of the fuel may be drained either by opening the valve at the inboard end of each tank or by siphoning. The remaining fuel in the lines may be drained through the gascolators and the two drains located on the bottom of the fuselage, inboard of the right flap.

8.23 TIRE INFLATION

For maximum service from the tires, keep them inflated to the proper pressures. The main gear tires should be inflated to 55 psi and the nose gear tire should be inflated to 40 psi.

Interchange the tires on the main wheels, if necessary, to produce even wear. All wheels and tires are balanced before original installation, and the relationship of the tire, tube, and wheel should be maintained if at all possible. Unbalanced wheels can cause extreme vibration on takeoff. In the installation of new components, it may be necessary to rebalance the wheel with the tire mounted.

When checking the pressure, examine the tires for wear, cuts, bruises, and slippage.

8.25 BATTERY SERVICE

Access to the 12-volt 35 ampere hour battery is gained through the nose baggage compartment. It is located in the forward portion of the nose baggage compartment. The battery container has a plastic drain tube which is normally closed off. This tube should be opened occasionally to drain off any accumulation of liquid.

The battery fluid level must not be brought above the baffle plates. It should be checked every 30 days to determine that the fluid level is proper and the connections are tight and free of corrosion. DO NOT fill the battery above the baffle plates. DO NOT fill the battery with acid - use distilled water only. A hydrometer check will determine the percent of charge in the battery.

If the battery is not properly charged, recharge it starting with a rate of 4 amperes and finishing with a rate of 2 amperes. Quick charges are not recommended.

The external power receptacle, if installed, is located on the left side of the nose section. Be sure that the master switch is off while inserting or removing a plug at this receptacle. Connect 12 VDC external power source only.

Refer to the PA-34-220T Service Manual for detailed procedures for cleaning and servicing the battery.

8.27 SERIAL NUMBER PLATES

The serial number plate is located on the left side of the fuselage near the leading edge of the stabilator. The serial number should always be used when referring to the airplane on service or warranty matters.

8.29 LUBRICATION

Lubrication at regular intervals is an essential part of the maintenance of an airplane. For lubrication instructions and a chart showing lubrication points, types of lubricants to be used, lubrication methods and recommended frequencies, refer to the PA-34-220T Service Manual.

8.31 CLEANING

(a) Cleaning Engine Compartment

Before cleaning the engine compartment, place a strip of tape on the magneto vents to prevent any solvent from entering these units.

(1) Place a large pan under the engine to catch waste.
(2) With the engine cowling removed, spray or brush the engine with solvent or a mixture of solvent and degreaser. In order to remove especially heavy dirt and grease deposits, it may be necessary to brush areas that were sprayed.

CAUTION

Do not spray solvent into the alternator, pressure pump, starter, air intakes, or alternate air inlets.

(3) Allow the solvent to remain on the engine from five to ten minutes. Then rinse the engine clean with additional solvent and allow it to dry.

CAUTION

Do not operate the engine until excess solvent has evaporated or otherwise been removed.

(4) Remove the protective tape from the magnetos.
(5) Lubricate the controls, bearing surfaces, etc., in accordance with the Lubrication Chart in the PA-34-220T Service Manual.

(b) Cleaning Landing Gear

Before cleaning the landing gear, place a plastic cover or similar material over the wheel and brake assembly.

(1) Place a pan under the gear to catch waste.
(2) Spray or brush the gear area with solvent or a mixture of solvent and degreaser, as desired. Where heavy grease and dirt deposits have collected, it may be necessary to brush areas that were sprayed, in order to clean them.
(3) Allow the solvent to remain on the gear from five to ten minutes. Then rinse the gear with additional solvent and allow to dry.
(4) Remove the cover from the wheel and remove the catch pan.
(5) Lubricate the gear in accordance with the Lubrication Chart in the PA-34-220T Service Manual.

CAUTION

Do not brush the micro switches.

(c) Cleaning Exterior Surfaces

The airplane should be washed with a mild soap and water. Harsh abrasives or alkaline soaps or detergents could make scratches on painted or plastic surfaces or could cause corrosion of metal. Cover areas where cleaning solution could cause damage. To wash the airplane, use the following procedure:

(1) Flush away loose dirt with water.
(2) Apply cleaning solution with a soft cloth, a sponge or a soft bristle brush.
(3) To remove exhaust stains, allow the solution to remain on the surface longer.
(4) To remove stubborn oil and grease, use a cloth dampened with naphtha.
(5) Rinse all surfaces thoroughly.
(6) Any good automotive wax may be used to preserve painted surfaces. Soft cleaning cloths or a chamois should be used to prevent scratches when cleaning or polishing. A heavier coating of wax on the leading surfaces will reduce the abrasion problems in these areas.

(d) Cleaning Windshield and Windows

(1) Remove dirt, mud and other loose particles from exterior surfaces with clean water.
(2) Wash with mild soap and warm water or with aircraft plastic cleaner. Use a soft cloth or sponge in a straight back and forth motion. Do not rub harshly.
(3) Remove oil and grease with a cloth moistened with kerosene.

CAUTION

Do not use gasoline, alcohol, benzene, carbon tetrachoride, thinner, acetone, or window cleaning sprays.

(4) After cleaning plastic surfaces, apply a thin coat of hard polishing wax. Rub lightly with a soft cloth. Do not use a circular motion.
(5) A severe scratch or mar in plastic can be removed by rubbing out the scratch with jeweler's rouge. Smooth both sides and apply wax.

(e) Cleaning Headliner, Side Panels and Seats

(1) Clean headliner, side panels, and seats with a stiff bristle brush, and vacuum where necessary.
(2) Soiled upholstery, except leather, may be cleaned with a good upholstery cleaner suitable for the material. Carefully follow the manufacturer's instructions. Avoid soaking or harsh rubbing.

CAUTION

Solvent cleaners require adequate ventilation.

(3) Leather should be cleaned with saddle soap or a mild hand soap and water.

(f) Cleaning Carpets

To clean carpets, first remove loose dirt with a whisk broom or vacuum. For soiled spots and stubborn stains use a nonflammable dry cleaning fluid. Floor carpets may be removed and cleaned like any household carpet.

(g) Cleaning Deicing Equipment*

The deicers should be cleaned when the aircraft is washed using a mild soap and water solution.

In cold weather, wash the boots with the airplane inside a warm hangar if possible. If the cleaning is to be done outdoors, heat the soap and water solution before taking it out to the airplane. If difficulty is encountered with the water freezing on boots, direct a blast of warm air along the region being cleaned using a portable ground heater.

As an alternate cleaning solvent, use benzol or nonleaded gasoline. Moisten the cleaning cloth in the solvent, scrub lightly, and then, with a clean, dry cloth, wipe dry so that the cleaner does not have time to soak into the rubber. Petroleum products such as these are injurious to rubber, and therefore should be used sparingly if at all.

With the deicer boots properly cleaned, a coating of Agemaster No. 1 should be applied as described in the PA-34-220T Service Manual. This treatment helps protect the boot rubber from ozone attack, aging and weathering.

After the Agemaster coating is dry, a coating of B.F. Goodrich Icex may be applied to the boots if icing conditions are anticipated. For specific instructions refer to the PA-34-220T Service Manual.

*Optional equipment

8.33 WINTERIZATION

For winter operation a winterization kit is installed on the inlet opening of the oil cooler outboard chamber of the plenum chamber. This kit should be installed whenever the ambient temperature is 50° F or less. When the kit is not being used it can be stowed in the nose cone compartment, left hand side, forward of the door, using the strap provided.

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SECTION 9

SUPPLEMENTS

9.1 GENERAL

This section provides information in the form of Supplements which are necessary for operation of the airplane when equipped with one or more of the various optional systems and equipment not provided with the standard airplane.

All of the Supplements listed on the preceding pages are "FAA Approved" and are required to be aboard the airplane when the related equipment is installed. Supplements for equipment installed should be identified to avoid confusion. Supplements for equipment not installed may at the owners discretion be segregated or removed from the pilot's operating handbook.

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PILOT'S OPERATING HANDBOOK AND FAA APPROVED AIRPLANE FLIGHT MANUAL

SUPPLEMENT NO. 1 FOR PORTABLE OXYGEN SYSTEM INSTALLATION-SCOTT AVIATION PRODUCTS EXECUTIVE MARK III PART NUMBER 802180-00 OR 802180-01

SECTION 1 - GENERAL

This supplement supplies information necessary for the operation of the airplane when the optional portable oxygen system is installed in accordance with "FAA Approved" Piper data. The information contained within this supplement is to be used in conjunction with the complete handbook.

This supplement has been "FAA Approved" and must remain in this handbook at all times when the optional portable oxygen system is installed.

FAA APPROVED Ward Evans
WARD EVANS
D.O.A. NO. SO-1
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VERO BEACH, FLORIDA

This portable oxygen system provides supplementary oxygen for the crew and passengers during high altitude flights (above 10,000 feet). The system is secured to the middle center seat with the forward facing seating arrangement and mounted between the center seats with the club seating arrangement.

The major components of the system consist of two console cylinder kits and six oxygen masks. Each console is equipped with a 22 cubic foot oxygen cylinder, an oxygen supply gauge, an ON-OFF flow control knob and two plug-in receptacles. Two single supply line masks and two dual supply line masks, which utilize dual manifold connectors, are provided to supply six masks with only four outlets.

Each cylinder is enclosed in a console carrying case with a separate supply gauge and ON-OFF flow control knob mounted on the sloped face of each unit. Two plug-in outlets are mounted below the gauge and control knob on each console. The masks for the rear seats are stowed in the pockets on the center seats and all other masks are stowed in the consoles.

When fully charged, each cylinder contains oxygen at a pressure of 1850 psi at 70° F. the filler port is enclosed by a cover at the rear of each unit. If high altitude flight is anticipated, it should be determined that the oxygen supply is adequate for the proposed flight and that the passengers are briefed. When oxygen is required, insert the mask plug-in connector into an outlet and lock by rotating the connector approximately 1/4 turn. Don mask(s) and rotate the ON-OFF control knob fully counterclockwise (approximately two full turns).

Each mask assembly oxygen line incorporates a flow indicator. When the red pellet in the indicator disappears, oxygen is flowing through the line normally. If the red indicator appears in any of the lines during a period when oxygen is essential, the airplane should be lowered to a safe altitude immediately.

Always remove fittings from the oxygen receptacles and stow the masks when they are not in use. Connect only those mask assemblies being used to prevent oxygen loss through an unused mask assembly. If the control knob is ON and the fitting is in the receptacle, oxygen will flow through the mask continuously. If a dual manifold connector is used, both masks must be donned. Masks may be damaged if they are not properly stowed.

WARNING

Positively no smoking while oxygen is being used by anyone in the airplane.

To stop the flow of oxygen through the system, the control knob should be turned OFF by rotating fully clockwise, finger tight.

To preclude the possibility of fire by spontaneous combustion, oil, grease, paint, hydraulic fluid and other flammable material should be kept away from oxygen equipment.

SECTION 2 - LIMITATIONS

(a) No smoking allowed.
(b) The aircraft is restricted to six occupants with two (2) oxygen units installed.
(c) The aircraft is restricted to four occupants with one (1) oxygen unit installed.
(d) Oxygen duration:

DURATION IN HOURS AT ALTITUDE

Persons Using Each Unit	10,000	15,000	20,000	25,000
1	6.3	4.7	3.8	3.3
2	3.2	2.4	1.9	1.7
3	2.1	1.6	1.3	1.1
4	1.6	1.2	0.95	0.8

NOTE

For six occupants maximum duration will be obtained with three (3) persons utilizing each unit. See preceding chart for number of persons vs duration (per unit).

SECTION 3 - EMERGENCY PROCEDURES

(a) Time of useful consciousness at 25,000 feet is approximately 3 minutes.
(b) If oxygen flow is interrupted as evidenced by the flow indicators or hypoxic indication:
   (1) Install another mask unit.
   (2) Install mask connection in an unused outlet if available.
   (3) If flow is not restored, immediately descend to below 12,500 feet.

In the event an emergency descent becomes necessary, CLOSE the throttles and move the propeller controls full FORWARD. Adjust the mixture control as necessary to attain smooth operation. Extend the landing gear at 130 KIAS and maintain this airspeed.

SECTION 4 - NORMAL PROCEDURES

PREFLIGHT

(a) Check oxygen quantity.
(b) Installation (Forward facing seating arrangement only)
   (1) Remove middle center seat and secure units to seat by use of belts provided.
   (2) Reinstall seat and secure seat by adjusting the middle seat belt tightly around seat aft of the oxygen units.
(c) Installation (Club seating arrangement only)
   (1) Install mounting base between center seats utilizing slotted receptacles for front attachment points and bolts for aft attachment points.
   (2) Slide oxygen bottles into position on top of mounting base ensuring that all mounting lugs engage in the slotted receptacle and that the locking pin is in the raised position.
(d) Turn on oxygen system and check flow indicators on all masks. Masks for the two aft seats are stowed in the seat pockets of the middle seats. All other masks are stowed in the oxygen system containers.

IN-FLIGHT

(a) Adjust oxygen mask.
(b) Turn on system.
(c) Monitor flow indicators and quantity.

CAUTION

Use of oxygen unit is prohibited when gauge approaches red area.

SECTION 5 - PERFORMANCE

No changes to the basic performance provided by Section 5 of this Pilot's Operating Handbook are necessary for this supplement.

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PILOT'S OPERATING HANDBOOK AND FAA APPROVED AIRPLANE FLIGHT MANUAL

SUPPLEMENT NO. 2 FOR FIXED OXYGEN SYSTEM INSTALLATION - SCOTT AVIATION PRODUCTS AMBASSADOR MARK III PART NUMBERS 36960-3 or 87441-2

SECTION 1 - GENERAL

This supplement supplies information necessary for the operation of the airplane when the optional fixed oxygen system is installed in accordance with "FAA Approved" Piper data. The information contained within this supplement is to be used in conjunction with the complete handbook.

This supplement has been "FAA Approved" and must remain in this handbook at all times when the optional fixed oxygen system is installed.

FAA APPROVED Ward Evans
WARD EVANS
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VERO BEACH, FLORIDA

This fixed oxygen system provides supplementary oxygen for the crew and passengers during high altitude flights (above 10,000 feet). The major components of the Scott oxygen system are a 63 cubic foot oxygen cylinder, an oxygen supply gauge, an ON-OFF flow control knob, a pressure regulator, six plug-in receptacles and six oxygen masks.

On some models the oxygen cylinder is mounted aft in the tail cone. When fully charged, the cylinder contains oxygen at a pressure of 1850 psi at 70°F. The oxygen supply gauge is mounted in the aft overhead vent duct. The oxygen flow control knob, labeled "Oxygen Pull-On" is mounted in the pilot's overhead panel. The pressure regulator is mounted directly on the oxygen cylinder, once the oxygen flow control knob is on, each of the oxygen plug-in receptacles operates as an automatic on-off valve. The oxygen cylinder can be recharged through the access door aft of the rear window on the left side of the fuselage.

On other models the oxygen cylinder is mounted in the forward baggage compartment. When fully charged, the cylinder contains oxygen at a pressure of 1850 psi at 70°F. The oxygen supply gauge is mounted in the co-pilot's instrument panel. The oxygen flow control knob, labeled "Oxygen Pull-On" is also mounted in the copilot's instrument panel. The pressure regulator is mounted directly on the oxygen cylinder, once the oxygen flow control knob is on, each of the oxygen plug-in receptacles operates as an automatic on-off valve. The oxygen cylinder can be recharged through the forward baggage compartment on the left side of the fuselage.

If high altitude flight is anticipated, it should be determined that the oxygen supply is adequate for the proposed flight and that the passengers are briefed. When oxygen is required, the control knob should be pulled to the ON position, allowing oxygen to flow from the cylinder through the system. Connecting the constant flow mask fitting to a receptacle and turning it 90 degrees clockwise, automatically releases oxygen to the mask through the on-off valve feature of the receptacle. The occupant then dons the mask and breathes normally for a sufficient supply of oxygen.

Each mask assembly oxygen line incorporates a flow indicator. When the red pellet in the indicator disappears, oxygen is flowing through the line normally. If the red indicator appears in any of the lines during a period when oxygen use is essential, the airplane should be lowered to a safe altitude immediately.

When not in use, mask may be stowed in the storage pockets behind the front and center seats. Always remove fittings from the oxygen receptacles

and stow the mask when they are not in use. If the control knob is pulled on and the fitting is in the receptacle, oxygen will flow through the mask continuously. Masks may be damaged if they are not properly stowed.

CAUTION

Postively NO SMOKING while oxygen is being used by anyone in the aircraft.

To stop the flow of oxygen through the system, the control knob should be pushed to the OFF position. To bleed down low pressure lines, it is recommended that the mask assembly be left connected to the outlet for at least three minutes after the control knob is turned off.

To preclude the possibility of fire by spontaneous combustion, oil, grease, paint, hydraulic fluid, and other flammable material should be kept away from oxygen equipment.

SECTION 2 - LIMITATIONS

(a) No smoking allowed when oxygen system is in use.
(b) Oxygen duration: (Bottle pressure 1850 PSI).
(c) Six occupants maximum when oxygen is required.

DURATION IN HOURS AT ALTITUDE
(Based on 90% Consumption)

Persons Using System	10,000	15,000	20,000	25,000
1	7.7	8.1	8.3	8.5
2	3.9	4.1	4.2	4.3
3	2.6	2.7	2.8	2.8
4	1.9	2.0	2.1	2.1
5	1.5	1.6	1.7	1.7
6	1.3	1.4	1.4	1.4

SECTION 3 - EMERGENCY PROCEDURES

(a) Time of useful consciousness at 25,000 feet is approximately 3 minutes.

(b) If oxygen flow is interrupted as evidenced by the flow indicators or hypoxic indications:
   (1) Install another mask unit.
   (2) Install mask connection in an unused outlet if available.
   (3) If flow is not restored, immediately descend to below 12,500 feet.

In the event an emergency descent becomes necessary, CLOSE the throttles and move the propeller controls full FORWARD. Adjust the mixture control as necessary to attain smooth operation. Extend the landing gear at 130 KIAS and maintain this airspeed.

SECTION 4 - NORMAL PROCEDURES

PREFLIGHT

(a) Check oxygen quantity.
(b) Turn on oxygen system and check flow indicators on all masks. All masks are stored in the seat pockets of the front and middle seats.

IN-FLIGHT

(a) Adjust oxygen mask.
(b) Turn on system.
(c) Monitor flow indicators and quantity.

CAUTION

Do not use oxygen system below 200 PSI to prevent contamination and or moisture from entering depleted cylinder-regulator assembly. If cylinder has been depleted it must be removed and refurbished in accordance with the manufacturer's recommended procedures.

SECTION 5 - PERFORMANCE

No changes to the basic performance provided by Section 5 of this Pilot's Operating Handbook are necessary for this supplement.

PILOT'S OPERATING HANDBOOK
AND
FAA APPROVED AIRPLANE FLIGHT MANUAL

SUPPLEMENT NO. 3
FOR
AIR CONDITIONING INSTALLATION
PIPER DWG. 36809

SECTION 1 - GENERAL

This supplement supplies information necessary for the operation of the airplane when the optional air conditioning system is installed in accordance with "FAA Approved" Piper data. The information contained within this supplement is to be used in conjunction with the complete handbook.

This supplement has been "FAA Approved" and must remain in this handbook at all times when the optional air conditioning system is installed.

FAA APPROVED Ward Evans

WARD EVANS
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VERO BEACH, FLORIDA

The air conditioning system is a recirculating air system. The major components include an evaporator, condenser, compressor, blower, switches and temperature controls.

The evaporator is located behind the rear baggage compartment. This cools the air used for the air conditioning system.

The condenser is mounted aft of the fire wall on the left engine. A retractable condenser scoop extends when the air conditioner is ON and retracts to a flush position when the air conditioner is OFF.

If the air conditioner is operated on the ground, the condenser scoop operates to a ground opening position which is larger than the in-flight opening. A circuit through the squat switch on the right main gear prevents the scoop from operating to the ground opening when the aircraft is in flight.

The compressor is mounted on the rear outboard side of the left engine. It has an electric clutch which automatically engages or disengages the compressor.

Air from the baggage area is drawn through the evaporator by the blower and distributed through an overhead duct to individual outlets located adjacent to each occupant.

The switches and temperature control are located on the lower right side of the instrument panel. The temperature control regulates the temperature of the cabin. Turning the control clockwise increases cooling; counterclockwise decreases cooling.

The fan speed switch and the air conditioning ON-OFF switch are above the temperature control. The fan can be operated independently of the air conditioning; however, the fan must be ON for air conditioner operation. Turning either switch OFF will disengage the compressor clutch and retract the condenser door. Cooling air should be felt within one minute after the air conditioner is turned on.

NOTE

If the system is not operating in 5 minutes, turn the system OFF until the fault is corrected.

The fan switch allows operation of the fan with the air conditioner turned OFF to aid in cabin air circulation. "LOW" or "HIGH" can be selected to direct a flow of air through the air conditioner outlets in the overhead duct. These outlets can be adjusted or turned off individually.

The condenser door light is located on the annunciator panel and illuminates when the door is open and extinguishes when the door is closed.

A circuit breaker on the circuit breaker panel protects the aircraft electrical system.

SECTION 2 - LIMITATIONS

(a) To ensure maximum climb performance the air conditioner must be turned OFF manually prior to takeoff to disengage the compressor and retract the condenser door. Also the air conditioner must be turned OFF manually before the landing approach in preparation for a possible go-around.

(b) Placards
In full view of the pilot, in the area of the air conditioner controls when the air conditioner is installed:

WARNING

AIR CONDITIONER MUST BE OFF PRIOR TO TAKEOFF AND LANDING AND ONE ENGINE INOPERATIVE OPERATIONS.

SECTION 3 - EMERGENCY PROCEDURES

No changes to the basic Emergency Procedures provided by Section 3 of this Pilot's Operating Handbook are necessary for this supplement.

SECTION 4 - NORMAL PROCEDURES

Prior to takeoff, the air conditioner should be checked for proper operation as follows:

(a) Check aircraft battery switch ON.
(b) Turn the air conditioner control switch to ON and the fan switch to one of the operating positions - the A/C DOOR OPEN warning light will illuminate, thereby indicating proper air conditioner condenser door actuation.
(c) Turn the air conditioner control switch to OFF - the A/C DOOR OPEN warning light will go out, thereby indicating the air conditioner door is in the retracted position.
(d) If the A/C DOOR OPEN light does not respond as specified above, an air conditioner system or indicator bulb malfunction is indicated and further investigation should be conducted prior to flight.

The above operational check may be performed during flight if an in flight failure is suspected.

The condenser door light is located on the annunciator panel and illuminates when the door is open and extinguishes when the door is closed.

SECTION 5 - PERFORMANCE

Operation of the air conditioner will cause slight decreases in cruise speed and range. Power from the engine is required to run the compressor, and the condenser door, when extended, causes a slight increase in drag. When the air conditioner is turned OFF there is normally no measurable difference in climb, cruise or range performance of the airplane.

NOTE

To ensure maximum climb performance the air conditioner must be turned OFF manually before takeoff to disengage the compressor and retract the condenser door. Also the air conditioner must be turned OFF manually before the landing approach in preparation for a possible go-around. The air conditioner must be OFF during all one engine inoperative operations.

Although the cruise speed and range are only slightly affected by the air conditioner operation, these changes should be considered in preflight planning. To be conservative, the following figures assume that the compressor is operating continuously while the airplane is airborne. This will be the case only in extremely hot weather.

(a) The decrease in true airspeed is approximately 4 KTS at all power settings.
(b) The decrease in range may be as much as 25 nautical miles for the 93 gallon capacity.
(c) The decrease in range may be as much as 35 nautical miles for the 123 gallon capacity.

Climb performance is affected by the air conditioner operation. A decrease in the rate of climb of as much as 80 fpm can be expected at all altitudes with the air conditioner operating.

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PILOT'S OPERATING HANDBOOK AND FAA APPROVED AIRPLANE FLIGHT MANUAL

SUPPLEMENT NO. 4 FOR KFC 200 AUTOMATIC FLIGHT CONTROL SYSTEM (WITH FLIGHT DIRECTOR INSTALLATION) PIPER DWG. 36840

SECTION 1 - GENERAL

This supplement is to acquaint the pilot with the operation of the KFC 200 Automatic Flight Control System with optional Flight Director as installed in the PA-34-220T Seneca III in accordance with "FAA Approved" Piper data. The airplane must be operated within the limitations herein specified.

This supplement has been "FAA Approved" based on King STC SA1147CE and must remain in this handbook at all times when the optional King KFC 200 Automatic Flight Control System is installed.

FAA APPROVED Ward Evans
WARD EVANS
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PIPER AIRCRAFT CORPORATION
VERO BEACH, FLORIDA

The KFC 200 is certified in this airplane with two axis control, pitch and roll. The system may be operated as a flight director alone with the pilot steering the airplane to the flight director command presentation or the autopilot can be engaged to steer the airplane to the flight director command presentation.

The airplane is equipped with a manual electric trim system which is controlled by pilot operation of the trim switch.

The autopilot uses the electric trim to accomplish trimming to unload the autopilot elevator servo so that autopilot disengagement does not result in transient airplane motion. An autotrim/electric pitch trim monitor is provided in the autopilot. Autotrim and/or electric pitch trim faults are visually annunciated on the Mode Annunciator and accompanied by an audible warning.

ABBREVIATIONS

AFCS	Automatic Flight Control System
ALT	Altitude or Altitude Hold
AP	Autopilot
APPR	Approach
ARM	System Arm for Capture
BC	Back Course
CDI	Course Deviation Indicator or Control
CPLD	Coupled
CWS	Control Wheel Steering
DISC	Disconnect
FCS	Flight Control System
FD	Flight Director
FDI	Flight Director Indicator
GA	Go Around
GS	Glide Slope
HDG	Heading Select
LOC	Localizer
NAV	Navigation
PAH	Pitch Attitude Hold
PNI	Pictorial Navigation Indicator

SECTION 2 - LIMITATIONS

(a) During autopilot operation, pilot must be seated at the controls with seat belt fastened. Operation is restricted to left side pilot position.
(b) Maximum speed for autopilot operation is 200 KIAS.
(c) The maximum altitude for operation of the autopilot has not been determined. The maximum altitude flight tested was 24,000 feet.
(d) Do not extend flaps beyond 25° during autopilot operation.
(e) The autopilot must be disengaged during takeoff and landing.
(f) System approved for Category I operation only (APPR or BC selected).
(g) Autopilot attitude command limits:

Pitch	±15°
Roll	±25°

NOTE

In accordance with FAA recommendations, use of "Altitude Hold" mode is not recommended during operation in severe turbulence.

(h) Placards:
Location - Pilot's control wheel, left horn:

AP DISC   TRIM INTERRUPT

- Pilot's control wheel, left horn:

CWS

- Pilot's control wheel, left horn:

TRIM UP/DN

- Left throttle lever:

GO AROUND

SECTION 3 - EMERGENCY PROCEDURES

(a) AUTOPILOT MALFUNCTION
   (1) Emergency Disengagement of AP - Hold the Control Wheel firmly and press the AP DISC/TRIM INTERRUPT Switch.

(b) ELECTRIC TRIM MALFUNCTION (either manual electric or autotrim)
   (1) AP DISC/TRIM INTERRUPT Switch - Press and hold down until recovery can be made.
   (2) RADIO POWER Switch - OFF.
   (3) Aircraft - manually retrim.
   (4) PITCH TRIM circuit breaker - Pull.
   (5) RADIO POWER Switch - ON.

CAUTION

When disconnecting the autopilot after a trim malfunction, hold the control wheel firmly (up to 45 pounds of force on the control wheel may be necessary to hold the aircraft level).

(c) ENGINE FAILURE (COUPLED)
   (1) Disengage AP.
   (2) Follow basic Airplane Flight Manual engine inoperative procedures.
   (3) Airplane rudder and aileron axes must be manually trimmed prior to engaging autopilot for engine inoperative operations.

CAUTION

If rudder and aileron trim cannot be maintained when power is changed during a single engine inoperative coupled approach, disengage autopilot and continue approach manually.

CAUTION

At airspeeds below 110 MPH/96 KTS IAS, rapid power application may cause a pronounced pitch up attitude of 20° or more.

(d) AUTOPILOT DISENGAGEMENT

(1) The autopilot can be manually disengaged by the following actions:

a. Press the AP DISC/TRIM INTERRUPT switch on the pilot's control wheel.
b. Move the Autopilot ON-OFF handle to the OFF position.
c. Engage the Go-Around mode.
d. Pull the AUTOPILOT circuit breaker out (OFF).
e. Turn off the RADIO POWER switch.
f. Operate manual electric trim switch UP or DN.

(2) The following conditions will cause the Autopilot to automatically disengage:

a. Power failure.
b. Internal Flight Control System failure.
c. With the KCS 55A compass system, a loss of compass valid (displaying HDG flag) disengages the Autopilot and Flight Director when a mode using heading information is engaged. With the HDG flag present only vertical modes can be selected for FD or Autopilot operation.

(e) MAXIMUM ALTITUDE LOSSES DUE TO AUTOPILOT MALFUNCTIONS

Cruise, Climb, Descent	400 feet
Maneuvering	100 feet
APPR	50 feet
SE APPR	50 feet

CAUTION

When the autopilot is engaged, manual application of a force to the pitch axis of the control wheel for a period of three seconds or more will result in the autotrim system operating in the direction to create a force opposing the pilot. This opposing mistrim force will continue to increase as long as the pilot applies a force to the control wheel, and will ultimately overpower the autopilot. If the autopilot is disengaged under these conditions, the pilot may be required to exert control forces in excess of 50 pounds to maintain the desired airplane attitude. The pilot will have to maintain this control force while he manually retrims the airplane.

SECTION 4 - NORMAL PROCEDURES

(a) The BATTERY switch function is unchanged and can be used in an emergency to shut off all electrical power while the problem is isolated.
(b) The RADIO POWER switch supplies power to the avionics bus bar of the radio circuit breakers, AP and TRIM circuit breakers.
(c) The KFC 200 is controlled by the following circuit breakers:

AUTOPILOT - This suplies power to the FCS KC 295 Computer, KC 290 Mode Controller, KA 285 Annunciator Panel, KI 256 FDI, and AP Pitch and Roll Servos.

FCS MASTER - This in conjunction with the radio power switch supplies power to the avionics bus.

COMPASS SYSTEM - This supplies power to the KCS 55A Compass System.

PITCH TRIM - This supplies power to the FCS Autotrim and manual electric trim systems.

(d) FCS WARNING FLAGS AND ANNUNCIATORS

The KI 256 Flight Director Indicator does not have a warning flag, however the command bars will be biased out of view whenever the system is invalid or a FD mode is not engaged.

HDG - This warning flag mounted in the Pictorial Navigation Indicator will be in view whenever the directional gyro information is invalid. If a HDG invalid occurs with either NAV, APPR, or HDG modes selected the AP and/or FD is disengaged. Basic FD mode may then be re-engaged along with any vertical mode and the AP re-engaged.

TRIM - The TRIM warning light, located in the lower right corner of the annunciator panel, will flash and be accompanied by an audible warning whenever the following autotrim and/or manual electric pitch trim failures occur. The Trim servo motor running without a command is monitored on the manual electric and autotrim. The trim servo motor not running when commanded to run and the trim servo motor running in the wrong direction are

monitored on Autotrim only. The TRIM warning light should flash at least 4 but not more than six times and the audible warning sounds when the test switch on the Mode Controller is depressed.

GS - The Glide Slope valid (GS pointer being in view on PNI) has to be present before GS may couple. If after GS coupled, the valid is lost, the system will flash the GS Annunciator and transfer from GS coupled to PAH with the FDI pitch command bar providing pitch attitude steering information. If the GS valid returns, the system will revert back to GS.

NAV FLAG - The NAV or APPR Modes (ARM or CPLD) may be selected and will function with or without a NAV warning flag present. The FDI bank steering will continue to provide steering information with or without a valid NAV signal.

AP DISCONNECT ALERT - The Autopilot Disconnect Alert will sound an audible warning for approximately 2 seconds whenever the autopilot engage lever on the KC 290 Mode Controller is disengaged.

(e) PILOT'S CONTROL WHEEL SWITCH FUNCTIONS

AP DISC/TRIM INTERRUPT - This emergency disconnect switch will disengage the AP, interrupt the power to the electric trim system, and disconnect all FD Modes. To resume AP control, a FD Mode and the AP lever on the Mode Controller must be re-engaged. In the event of electric trim or autotrim failure, the switch can be held depressed, which removes all power from the trim system to allow the pilot time to turn off the RADIO POWER switch and pull the (PITCH TRIM) circuit breaker.

CWS - This switch when depressed and held will allow the pilot to manually fly the airplane without disengaging the AP. When the switch is released the AP will resume control, (within the pitch and roll attitude limits). The CWS switch will resync the FD in PAH, or ALT hold and will transfer the GA mode to PAH. When the CWS is held depressed, Manual Electric Trim may be operated without disengaging the AP.

MANUAL PITCH TRIM - Manual Electric Pitch Trim is activated by a dual action type switch that requires both parts to be moved simultaneously for actuating up or down trim commands. Operation of the manual electric pitch trim switch will disengage the AP lever switch on the Mode Controller (except when CWS switch is held depressed as previously noted).

GA - The Go Around switch is located on the left throttle and the operation of the switch will indicate a fixed angle of climb of 6° on the FDI. Selection of the GA Mode when in APPR or NAV CPLD Mode will disengage the mode and revert to the FD Mode (wings level) for lateral steering. The AP, if engaged, will disengage. However, the AP may be engaged/re-engaged with the GA Mode selected and will follow the FDI pitch command to climb at the fixed angle.

NOTE

The flight control system incorporates its own annunciator panel which is located on the instrument panel. The modes and indications given on the annunciator panel are placarded on the face of the lenses and illuminate when the respective modes are active. The switches on the mode selector are the push-on, push-off type. When engaged, the corresponding flight director/autopilot annunciator light illuminates. The V-bars on the flight director indicator will disappear to the bottom of the instrument when a flight director mode is not engaged. The V-bars must be in view before the autopilot can be engaged.

(f) BEFORE ENGAGING FLIGHT CONTROL SYSTEM

(1) Check that all circuit breakers for the system are in.
(2) Allow sufficient time for gyros to come up to speed and system warm-up (3-4 minutes).

(g) PREFLIGHT CHECK (Run prior to each flight)

(1) With no modes engaged and power applied to all systems, depress the TEST button on the Mode Controller. All mode annunciators will be illuminated on the annunciator panel and the red autotrim failure light will flash. At least four but no more than six flashes must be observed to indicate proper operation of the autotrim/manual electric trim feature and an audible warning should sound.

(2) Engage the FD, then engage AP, depress the CWS switch, center the flight controls and release CWS. Apply force to the controls to determine if the AP can be overpowered.

(3) Check that the pilot's emergency disconnect switch disconnects the autopilot.

(4) Perform the following manual electric pitch trim checks:

a. Actuate the left-side switch to the fore and aft positions. The trim solenoid should engage, but the trim should not run. (Solenoid engagement may be confirmed by additional force required to move trim wheel.)

b. Actuate the right-side switch to the fore and aft positions. The trim solenoid should not engage and the trim should not run.

c. Grasping the manual trim wheel, run the trim both up and down and check the overpower capability.

d. Press the AP DISC/TRIM INTERRUPT switch down and hold. The manual electric pitch trim will not operate either up or down.

e. Set manual trim for takeoff.

(5) Daily preflight check (must be performed prior to first flight of the day)

a. Engage the FD and AP and put in a pitch (UP) command using the vertical trim switch on Mode Controller. Hold the control column to keep it from moving and observe the autotrim run in the nose-up direction after approximately three seconds delay. Use the vertical trim switch and put in a pitch (DN) command. Hold the control column and observe the autotrim run in the nose-down direction after approximately 3 seconds delay.

b. Engage the HDG mode and the AP. Set the HDG bug to command a right turn. The control wheel will rotate clockwise. Set the HDG bug to command a left turn. The control wheel will rotate counterclockwise.

e. Run manual electric trim from full nose up to full nose down. Time required should be 39 +5 seconds.

CAUTION

Disengage the AP and check that the airplane manual pitch trim is in the takeoff position prior to takeoff.

NOTE

If the autopilot circuit breaker is pulled, the red "TRIM" failure light on the annunciator panel will be disabled and the audible warning will continuously sound indicating that the failure light is disabled. In this event, the "Pitch Trim" circuit breaker should be pulled and in-flight trim accomplished by using the manual pitch trim wheel.

(h) IN-FLIGHT OPERATION

(1) Engage Procedure:
After takeoff, clean up airplane and establish climb. Engage the FD mode first, monitor flight controls and engage AP. The pitch attitude will lock on any attitude up to 15° pitch attitude. Engaging and holding the CWS switch allows the pilot to momentarily revert to manual control, while retaining his previous modes, except GA, and conveniently resuming that profile at this discretion.

(2) Disengage Procedure:
Check the airplane trim by monitoring the command bars before disengaging AP. While monitoring the flight controls, disengage the system by one of the following methods: depressing the pilot's AP DISC/TRIM INTERRUPT switch, operation of the manual trim switch or by the operation of the AP engage lever on the Mode Controller. The AP light on the annunciator panel will flash at least four times and remain off and an audible warning will be heard to indicate the AP is disengaged. To deactivate the Flight Director System, depress the FD switch on the Mode Controller or press the AP DISC TRIM INTERRUPT switch on the pilot's control wheel.

(3) Flight Director Mode:
The FD must be engaged before the AP can be engaged. The FD mode alone indicates PAH and wings level. The pilot may choose to fly the FDI commands manually, without the AP engaged, by depressing the FD switch on the Mode Controller or selecting any of the other modes he wishes to follow. When the AP is engaged, the airplane will automatically follow the FDI commands. The FD may be disengaged by depressing the FD switch on the Mode Controller. If the AP is engaged the FD cannot be turned off without first disconnecting the AP or by pressing the AP DISC/TRIM INTERRUPT switch on the pilot's control wheel. FD mode engagement is displayed on the annunciator.

NOTE

The "Vertical Trim" switch, located on the Mode Controller, may be used to trim the command pitch attitude at a rate of one degree per second (the pitch attitude degrees legend on the airplane attitude indicator will not indicate accurate FDI pitch steering bar pitch attitude in degrees).

(4) Altitude Hold Mode (ALT):
When the ALT switch on the Mode Controller is pressed, the FDI will provide commands for maintaining the pressure altitude existing at the time the switch is depressed. For smooth operation, engage the ALT at no greater than 500 feet per minute climb/descent. The ALT will automatically disengage when glide slope couples or the go-around switch is depressed. ALT hold may be turned off at any time by depressing the ALT switch. ALT engagement is displayed on the annunciator panel.

NOTE

The "Vertical Trim" switch, located on the Mode Controller, may be used to change or trim the command altitude up or down at 500 to 700 FPM without disengaging the mode. The new pressure altitude that exists when the switch is released will then be held.

(5) Heading Mode (HDG):
Set the heading bug to the desired heading on the PNI, depress the HDG switch on the Mode Controller and HDG will be displayed on the annunciator panel. The FDI and/or AP will command a turn to the heading selected. The pilot may then choose any new heading by merely setting the bug on a new heading. The FDI and/or AP will automatically command a turn in the direction of the new setting. To disengage the HDG mode, depress the HDG switch on the Mode Controller and observe the HDG light go out on the annunciator. The HDG mode will automatically disengage when APPR or NAV CPLD is achieved.

(6) Navigation Mode (NAV):
The Navigation mode may be selected by tuning the NAV receiver to the desired frequency, setting the CDI to the desired radial and depressing the NAV switch on the Mode Controller. The annunciator will indicate NAV ARM until capture of the selected course, unless the NAV switch is engaged with wings level and a centered needle on the CDI. Then the mode will go directly to NAV CPLD as displayed on the annunciator panel. The system can intercept at any angle up to 90° and will always turn toward the course pointer. If a condition requiring a capture exists at mode engagement, the pilot is required to set up an intercept angle using either HDG or FD mode. NAV may be disengaged by depressing the NAV switch or by engaging HDG when in NAV CPLD or engaging APPR when in NAV CPLD or NAV ARM.

CAUTION

The "NAV" mode of operation will continue to provide airplane commands and/or control without a valid VOR/LOC signal (NAV flag in view). Also erroneous navigation information may result from COMM radio interference with the NAV radio. This erroneous information may cause premature NAV captures as well as erroneous steering information. Should this occur reselect HDG mode and then reselect NAV mode.

(7) Approach Mode (APPR):
The Approach mode may be selected by tuning the NAV receiver to the desired VOR or LOC frequency, setting the CDI to the desired radial or inbound heading and depressing the APPR switch on the Mode Controller. The annunciator will indicate APPR ARM until the course is captured unless the APPR mode is engaged with wings level and there is a centered needle on the CDI. In that situation, the mode will go directly to APPR CPLD as displayed on the annunciator panel.

The system can intercept at any angle up to 90° and will always turn toward the course pointer. See approach procedure for more detail. APPR mode can be disengaged by depressing the APPR switch on the Mode Controller; by depressing the GO AROUND switch on the engine throttle control; or by engaging HDG when in APPR CPLD or engaging NAV when in APPR CPLD or APPR ARM.

CAUTION

The "APPR" mode of operation will continue to provide airplane commands and/or control without a valid VOR/LOC signal (NAV flag in view). Also erroneous navigation information may result from COMM radio interference with the NAV radio. This erroneous information may cause premature APPR captures as well as erroneous steering information. Should this occur reselect HDG mode and then reselect APPR mode.

(8) Back Course Mode (BC):
For BC operation, proceed as for normal approach mode, but engage BC mode after selecting APPR. The BC mode reverses the signals in the computer and cannot be engaged without a LOC frequency selected. BC status is indicated on the annunciator panel. BC mode can be disengaged by depressing either the BC, APPR or GO AROUND switches, or by selecting other than a LOC frequency on the NAV receiver.

(9) Vertical Mode Switch (Trim Up/Dn):
Operation of the vertical trim switch on the Mode Controller provides a convenient means of adjusting the ALT hold or PAH angle function without disengaging the mode.

(10) Go-Around Mode (GA):
The GA mode may be engaged at any time by depressing the GO AROUND switch on the left engine throttle. GA will illuminate on the annunciator panel indicating mode status. The GA mode provides a fixed pitch angle indication on the FDI. The AP, if engaged, will disengage. GA will cancel all other vertical modes as well as APPR or NAV CPLD.

(i) VOR PROCEDURES
(1) Tune NAV receiver to appropriate frequency.
(2) Set desired heading with the HDG BUG to intercept radial and engage HDG and AP. (Maximum recommended intercept angle 90°.)
(3) Select desired radial and engage NAV. The FCS will remain on HDG as indicated on the annunciator panel and in ARM on the NAV mode. When the airplane approaches the beam, the system will automatically couple, HDG will decouple and track in NAV mode and indicate CPLD on the annunciator panel.
(4) A new course may be selected over the VOR station when operating in the NAV mode, by selecting a new radial when the To-From indication changes.
(5) For VOR approach, see approach procedure.

(j) APPROACH PROCEDURES
(1) Tune ILS or VOR.
(2) Set CDI for front course.
(3) Set Heading Bug and engage HDG to intercept selected CDI course beam at desired angle. (Maximum recommended intercept angle 90°.)
(4) Engage APPR and note APPR ARM on the annunciator.
(5) When airplane approaches the selected CDI course, APPR will couple, HDG will decouple, the FDI and/or AP will give command or steering to track LOC, or VOR, and CPLD will illuminate on the annunciator panel.

(6) When the glide slope beam is intercepted, the glide slope (GS) will couple automatically and indicates GS on the annunciator panel. If the ALT mode was engaged prior to intercepting the glide slope, it will automatically disengage when GS couples. FDI and/or AP will now provide commands or steering to track LOC and GS. Adjust throttles to control speed on descent. Set HDG bug for missed approach but do not engage HDG.

NOTE

Should the "GA" mode be inadvertently selected during "APPR" mode operation, cancel "GA" mode (press CWS) prior to re-selection of the "APPR" mode. It may be necessary to use some combination of vertical trim and power to recenter the "GS" for "GS" coupling. Failure to follow this procedure will result in the "GS" mode being inhibited.

(7) When middle marker signal is received, system will automatically switch to a more stable track mode.

NOTE

Operation of marker test function after APPR CPLD will reduce the flight control system gains. If this should occur, the APPR switch should be recycled.

(8) Landing or missed approach
   a. Landing: Disengage AP and land.
   b. Missed Approach: See Go Around procedures.

(k) GO AROUND PROCEDURE
Depress the GO AROUND switch and perform missed approach procedure as per Airplane Flight Manual. The AP will disengage and the FDI will command a 6° climb attitude. When established in climb attitude the AP may be re-engaged and the APPR mode may be selected for a straight away missed approach or HDG may be selected to turn to the missed approach heading.

(l) BACK COURSE PROCEDURE
Same as front course except that BC is engaged after APPR is engaged and the airplane must be set for descent manually by holding the vertical trim control DN on the Mode Controller or by establishing the desired PAH using the CWS or vertical trim switch.

SECTION 5 - PERFORMANCE

No changes to the basic performance provided by Section 5 of this Pilot's Operating Handbook are necessary for this supplement.

PILOT'S OPERATING HANDBOOK
AND
FAA APPROVED AIRPLANE FLIGHT MANUAL

SUPPLEMENT NO. 5
FOR
KFC 200 AUTOMATIC FLIGHT CONTROL SYSTEM
(WITHOUT FLIGHT DIRECTOR INSTALLATION)
PIPER DWG. 36840

SECTION 1 - GENERAL

This supplement is to acquaint the pilot with the operation of the KFC 200 Automatic Flight Control System as installed in the PA-34-220T Seneca III in accordance with "FAA Approved" Piper data. The airplane must be operated within the limitations herein specified.

This supplement has been "FAA Approved" based on King STC SA1147CE and must remain in this handbook at all times when the optional King KFC 200 Automatic Flight Control System is installed.

FAA APPROVED Ward Evans
WARD EVANS
D.O.A. NO. SO-1
PIPER AIRCRAFT CORPORATION
VERO BEACH, FLORIDA

The KFC 200 is certified in this airplane with two axis control, pitch and roll.

The airplane is equipped with a manual electric trim system which is controlled by pilot operation of the trim switch.

When the autopilot is coupled, the autopilot uses the electric trim to accomplish automatic trimming to unload the autopilot elevator servo so that autopilot disengagement does not result in transient airplane motion. An autotrim electric pitch trim monitor is provided in the autopilot. Autotrim and or electric pitch trim faults are visually annunciated on the Mode Annunciator and accompanied by an audible warning.

ABBREVIATIONS

AFCS	Automatic Flight Control System
ALT	Altitude or Altitude Hold
AP	Autopilot
APPR	Approach
ARM	System Arm for Capture
BC	Back Course
CDI	Course Deviation Indicator or Control
CPLD	Coupled
CWS	Control Wheel Steering
DISC	Disconnect
FCS	Flight Control System
GS	Glide Slope
HDG	Heading Select
LOC	Localizer
NAV	Navigation
PAH	Pitch Attitude Hold
PNI	Pictorial Navigation Indicator

SECTION 2 - LIMITATIONS

(a) During autopilot operation, pilot must be seated at the controls with seat belt fastened. Operation is restricted to left side pilot position.
(b) Maximum speed for autopilot operation is 173 KIAS.
(c) The maximum altitude for operation of the autopilot has not been determined. The maximum altitude flight tested was 24,000 feet.
(d) Do not extend flaps beyond 25° during autopilot operation.
(e) The autopilot must be disengaged during takeoff and landing.
(f) System approved for Category I operation only (APPR or BC Mode selected).
(g) Autopilot attitude command limits:

Pitch	±15°
Roll	±25°

NOTE

In accordance with FAA recommendations, use of "Altitude Hold" mode is not recommended during operation in severe turbulence.

(h) Placards:
Location - Pilot's control wheel, left horn:

AP DISC   TRIM INTERRUPT

- Pilot's control wheel, left horn:

CWS

- Pilot's control wheel, left horn:

TRIM UP/DN

SECTION 3 - EMERGENCY PROCEDURES

(a) AUTOPILOT MALFUNCTION

(1) Emergency Disengagement of AP - Hold the Control Wheel firmly and press the AP DISC/TRIM INTERRUPT Switch.

(b) ELECTRIC TRIM MALFUNCTION (either manual electric or autotrim)

(1) AP DISC/TRIM INTERRUPT Switch - Press and hold down until recovery can be made.
(2) RADIO POWER Switch - OFF.
(3) Aircraft - manually retrim.
(4) PITCH TRIM circuit breaker - Pull.
(5) RADIO POWER Switch - ON.

CAUTION

When disconnecting the autopilot after a trim malfunction, hold the control wheel firmly (up to 45 pounds of force on the control wheel may be necessary to hold the aircraft level).

(c) ENGINE FAILURE (COUPLED)

(1) Disengage AP.
(2) Follow basic Airplane Flight Manual engine inoperative procedures.
(3) Airplane rudder and aileron axes must be manually trimmed prior to engaging autopilot for engine inoperative operations.

CAUTION

If rudder and aileron trim cannot be maintained when power is changed during a single engine inoperative coupled approach, disengage autopilot and continue approach manually.

CAUTION

At airspeeds below 110 MPH/96 KTS IAS, rapid power application may cause a pronounced pitch up attitude of 20° or more.

(d) AUTOPILOT DISENGAGEMENT

(1) The autopilot can be manually disengaged by the following actions:

a. Press the AP DISC/TRIM INTERRUPT switch on the pilot's control wheel.
b. Move the Autopilot ON-OFF handle to the OFF position.
c. Pull the AUTOPILOT circuit breaker out (OFF).
d. Turn off the RADIO POWER switch.
e. Operate manual electric trim switch UP or DN.

(2) The following conditions will cause the Autopilot to automatically disengage:

a. Power failure.
b. Internal Flight Control System failure.
c. With the KCS 55A compass system, a loss of compass valid (displaying HDG flag) disengages the Autopilot when a mode using heading information is engaged.

(e) MAXIMUM ALTITUDE LOSSES DUE TO AUTOPILOT MALFUNCTIONS

Cruise, Climb, Descent	400 feet
Maneuvering	100 feet
APPR	50 feet
SE APPR	50 feet

CAUTION

When the autopilot is engaged, manual application of a force to the pitch axis of the control wheel for a period of three seconds or more will result in the autotrim system operating in the direction to create a force opposing the pilot. This opposing mistrim force will continue to increase as long as the pilot applies a force to the control wheel, and will ultimately overpower the autopilot. If the autopilot is disengaged under these conditions, the pilot may be required to exert control forces in excess of 50 pounds to maintain the desired airplane attitude. The pilot will have to maintain this control force while he manually retrims the airplane.

SECTION 4 - NORMAL PROCEDURES

(a) The BATTERY switch function is unchanged and can be used in an emergency to shut off all electrical power while the problem is isolated.

(b) The RADIO POWER switch supplies power to the avionics bus bar of the radio circuit breakers, AP and TRIM circuit breakers.

(c) The KFC 200 is controlled by the following circuit breakers:

AUTOPILOT - This suplies power to the FCS KC 295 Computer, KC 292 Mode Controller, KA 285 Annunciator Panel, and AP Pitch and Roll Servos.

FCS MASTER - This in conjunction with the radio power switch supplies power to the avionics bus.

COMPASS SYSTEM - This supplies power to the KCS 55A Compass System.

PITCH TRIM - This supplies power to the FCS Autotrim and manual electric trim systems.

(d) FCS WARNING FLAGS AND ANNUNCIATORS

HDG - This warning flag mounted in the Pictorial Navigation Indicator will be in view whenever the directional gyro information is invalid. If a HDG invalid occurs with either NAV, APPR, or HDG modes selected the AP is disengaged. Basic AP mode may then be re-engaged along with any vertical mode.

TRIM - The TRIM warning light, located in the lower right corner of the annunciator panel, will flash and be accompanied by an audible warning whenever the following autotrim and/or manual electric pitch trim failures occur. The Trim servo motor running without a command is monitored on the manual electric and autotrim. The trim servo motor not running when commanded to run and the trim servo motor running in the wrong direction are monitored on Autotrim only. The TRIM warning light should flash at least 4 but not more than six times and the audible warning sounds when the test switch on the Mode Controller is depressed.

GS - The Glide Slope valid (GS pointer being in view on PNI) has to be present before GS may couple. If after GS coupled, the valid is lost, the system will flash the GS Annunciator and transfer from GS coupled to PAH. If the GS valid returns, the system will revert back to GS.

NAV FLAG - The NAV or APPR Modes (ARM or CPLD) may be selected and will function with or without a NAV warning flag present. The AP will continue to provide steering information with or without a valid NAV signal.

AP DISCONNECT ALERT - The Autopilot Disconnect Alert will sound an audible warning for approximately 2 seconds whenever the autopilot engage lever on the KC 292 Mode Controller is disengaged.

(e) PILOT'S CONTROL WHEEL SWITCH FUNCTIONS

AP DISC/TRIM INTERRUPT - This emergency disconnect switch will disengage the AP, interrupt the power to the electric trim system. To resume AP control, the AP lever on the Mode Controller must be re-engaged. In the event of electric trim or autotrim failure, the switch can be held depressed, which removes all power from the trim system to allow the pilot time to turn off the RADIO POWER switch and pull the (PITCH TRIM) circuit breaker.

CWS - This switch when depressed and held will allow the pilot to manually fly the airplane without disengaging the AP. When the switch is released the AP will resume control, (within the pitch and roll attitude limits). The CWS switch will resync PAH, or ALT hold. When the CWS is held depressed, Manual Electric Trim may be operated without disengaging the AP.

MANUAL PITCH TRIM - Manual Electric Pitch Trim is activated by a dual action type switch that requires both parts to be moved simultaneously for actuating up or down trim commands. Operation of the manual electric pitch trim switch will disengage the AP lever switch on the Mode Controller (except when CWS switch is held depressed as previously noted).

NOTE

The flight control system incorporates its own annunciator panel which is located on the instrument panel. The modes and indications given on the annunciator panel are placarded on the face of the lenses and illuminate when the respective modes are active. The switches on the mode selector are the push-on, push-off type. When engaged, the corresponding autopilot annunciator light illuminates. The autopilot must be engaged before any other mode can be selected.

(f) BEFORE ENGAGING FLIGHT CONTROL SYSTEM
   (1) Check that all circuit breakers for the system are in.
   (2) Allow sufficient time for gyros to come up to speed and system warm-up (3-4 minutes).

(g) PREFLIGHT CHECK (Run prior to each flight)
   (1) With no modes engaged and power applied to all systems, depress the TEST button on the Mode Controller. All mode annunciators except FD will be illuminated on the annunciator panel, including three marker lights. At least four but no more than six flashes must be observed to indicate proper operation of the autotrim/manual electric trim feature and an audible warning should sound.
   (2) Engage the AP, depress the CWS switch, center the flight controls and release the CWS switch. Apply force to the controls to determine if the AP can be overpowered.

(3) Check that the pilot's emergency disconnect switch disconnects the autopilot.

(4) Perform the following manual electric pitch trim checks:

a. Actuate the left-side switch to the fore and aft positions. The trim solenoid should engage, but the trim should not run. (Solenoid engagement may be confirmed by additional force required to move trim wheel.)

b. Actuate the right-side switch to the fore and aft positions. The trim solenoid should not engage and the trim should not run.

c. Grasping the manual trim wheel, run the trim both up and down and check the overpower capability.

d. Press the AP DISC/TRIM INTERRUPT switch down and hold. The manual electric pitch trim will not operate either up or down.

e. Set manual trim for takeoff.

(5) Daily preflight check (must be performed prior to first flight of the day)

a. Engage the AP and put in a pitch (UP) command using the vertical trim switch on Mode Controller. Hold the control column to keep it from moving and observe the autotrim run in the nose-up direction after approximately three seconds delay. Use the vertical trim switch and put in a pitch (DN) command. Hold the control column and observe the autotrim run in the nose-down direction after approximately 3 seconds delay.

b. Engage the HDG mode and the AP. Set the HDG bug to command a right turn. The control wheel will rotate clockwise. Set the HDG bug to command a left turn. The control wheel will rotate counterclockwise.

c. Run manual electric trim from full nose up to full nose down. Time required should be 39 ±5 seconds.

CAUTION

Disengage the AP and check that the airplane manual pitch trim is in the takeoff position prior to takeoff.

NOTE

If the autopilot circuit breaker is pulled, the red "TRIM" failure light on the annunciator panel will be disabled and the audible warning will continuously sound indicating that the failure light is disabled. In this event, the "Pitch Trim" circuit breaker should be pulled and in-flight trim accomplished by using the manual pitch trim wheel.

(h) IN-FLIGHT OPERATION

(1) Engage Procedure:
After takeoff, clean up airplane and establish climb. Monitor flight controls and engage AP. The pitch attitude will lock on any attitude up to 15° pitch attitude. Engaging and holding the CWS switch allows the pilot to momentarily revert to manual control, while retaining his previous modes and conveniently resuming that profile at this discretion.

(2) Disengage Procedure:
While monitoring the flight controls, disengage the system by one of the following methods: depressing the pilot's AP DISC TRIM INTERRUPT switch, operation of the manual trim switch or by the operation of the AP engage lever on the Mode Controller. The AP light on the annunciator panel will flash at least four times and remain off and an audible warning will be heard to indicate the AP is disengaged.

(3) AP Mode (AP):
The AP must be engaged before any other mode can be engaged. The AP Mode alone provides PAH and wings level control. The AP will automatically follow any other mode engaged. Disengaging the AP disengages all other modes.

NOTE

The "Vertical Trim" switch, located on the Mode Controller, may be used to trim the command pitch attitude at a rate of one degree per second.

(4) Altitude Hold Mode (ALT):
When the AP is engaged and the ALT switch on the Mode Controller is pressed, the airplane will maintain the pressure altitude existing at the time the switch is depressed. For smooth operation, engage the ALT at no greater than 500 feet per minute climb or descent. The ALT will automatically disengage when the glide slope couples. ALT hold may be turned off at any time by depressing the ALT switch. ALT engagement is displayed on the annunciator panel.

NOTE

The "Vertical Trim" switch, located on the Mode Controller, may be used to change or trim the command altitude up or down at 500 to 700 FPM without disengaging the mode. The new pressure altitude that exists when the switch is released will then be held.

(5) Heading Mode (HDG):
Set the heading bug to the desired heading on the PNI, engage the AP, depress the HDG switch on the Mode Controller and HDG will be displayed on the annunciator panel. The AP will command a turn to the heading selected. The pilot may then choose any new heading by merely setting the bug on a new heading. The AP will automatically command a turn in the direction of the new setting. To disengage the HDG mode, depress the HDG switch on the Mode Controller and observe the HDG light go out on the annunciator. The HDG mode will automatically disengage when APPR or NAV CPLD is achieved.

(6) Navigation Mode (NAV):
The Navigation mode may be selected by tuning the NAV receiver to the desired frequency, setting the CDI to the desired radial and depressing the NAV switch on the Mode Controller. The annunciator will indicate NAV ARM until capture of the selected course, unless the NAV switch is engaged with wings level and a centered needle on the CDI. Then the mode will go directly to NAV CPLD as displayed on the annunciator panel. The system can intercept at any angle up to 90° and will always turn toward the course pointer. If a condition requiring a

capture exists at mode engagement, the pilot is required to set up an intercept angle using either HDG or AP mode. NAV may be disengaged by depressing the NAV switch or by engaging HDG when in NAV CPLD or NAV ARM.

CAUTION

The "NAV" mode of operation will continue to provide airplane commands and/or control without a valid VOR/LOC signal (NAV flag in view). Also erroneous navigation information may result from COMM radio interference with the NAV radio. This erroneous information may cause premature NAV captures as well as erroneous steering information. Should this occur reselect HDG mode and then reselect NAV mode.

(7) Approach Mode (APPR):
The Approach mode may be selected by tuning the NAV receiver to the desired VOR or LOC frequency, setting the CDI to the desired radial or inbound heading and depressing the APPR switch on the Mode Controller. The annunciator will indicate APPR ARM until the course is captured unless the APPR mode is engaged with wings level and there is a centered needle on the CDI. In that situation, the mode will go directly to APPR CPLD as displayed on the annunciator panel.

The system can intercept at any angle up to 90° and will always turn toward the course pointer. See approach procedure for more detail. APPR mode can be disengaged by depressing the APPR switch on the Mode Controller; or by engaging HDG when in APPR CPLD or engaging NAV when in APPR CPLD or APPR ARM. The annunciator panel indicates the status of the approach mode.

CAUTION

The "APPR" mode of operation will continue to provide airplane commands and/or control without a valid VOR/LOC signal (NAV flag in view). Also erroneous navigation information may result from COMM radio interference with the NAV radio. This erroneous information may cause premature APPR captures as well as erroneous steering information. Should this occur reselect HDG mode and then reselect APPR mode.

(8) Back Course Mode (BC):
For BC operation, proceed as for normal approach mode, but engage BC mode after selecting APPR. The BC mode reverses the signals in the computer and cannot be engaged without a LOC frequency selected. BC status is indicated on the annunciator panel. BC mode can be disengaged by depressing either the BC, APPR, or by selecting other than a LOC frequency on the NAV receiver.

(9) Vertical Mode Switch (Trim Up/Dn):
Operation of the vertical trim switch on the Mode Controller provides a convenient means of adjusting the ALT hold or PAH angle function without disengaging the mode.

(i) VOR PROCEDURES

(1) Tune NAV receiver to appropriate frequency.
(2) Set desired heading with the HDG BUG to intercept radial and engage HDG and AP. (Maximum recommended intercept angle 90°.)
(3) Select desired radial and engage NAV. The FCS will remain on HDG as indicated on the annunciator panel and in ARM on the NAV mode. When the airplane approaches the beam, the system will automatically couple, HDG will decouple and track in NAV mode and indicate CPLD on the annunciator panel.
(4) A new course may be selected over the VOR station when operating in the NAV mode, by selecting a new radial when the To-From indication changes.
(5) For VOR approach, see approach procedure.

(j) APPROACH PROCEDURES

(1) Tune ILS or VOR.
(2) Set CDI for front course.
(3) Set Heading Bug and engage AP and HDG to intercept selected CDI course beam at desired angle. (Maximum recommended intercept angle 90°.)
(4) Engage APPR and note APPR ARM on the annunciator.
(5) When airplane approaches the selected CDI course, APPR will couple, HDG will decouple, the AP will track LOC, or VOR, and CPLD will illuminate on the annunciator panel.
(6) When the glide slope beam is intercepted, the glide slope (GS) will couple automatically and indicates GS on the annunciator panel. If the ALT mode was engaged prior to intercepting the glide slope, it will automatically disengage when GS couples. The AP will now track LOC and GS. Adjust throttles to control speed on descent. Set HDG bug for missed approach but do not engage HDG.
(7) When middle marker signal is received, system will automatically switch to a more stable track mode.

NOTE

Operation of marker test function after APPR CPLD will reduce the flight control system gains. If this should occur, the APPR switch should be recycled.

PILOT'S OPERATING HANDBOOK
AND
FAA APPROVED AIRPLANE FLIGHT MANUAL

SUPPLEMENT NO. 6
FOR
ICE PROTECTION SYSTEM INSTALLATION
PIPER DWG. 37700

SECTION 1 - GENERAL

This supplement supplies information necessary for the operation of the airplane when the optional ice protection system is installed in accordance with "FAA Approved" Piper data. The information contained within this supplement is to be used in conjunction with the complete handbook.

This supplement has been "FAA Approved" and must remain in this handbook at all times when the optional ice protection system is installed.

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For flight into known icing conditions, a complete ice protection system (Figure 9-1) is required on the Seneca III.

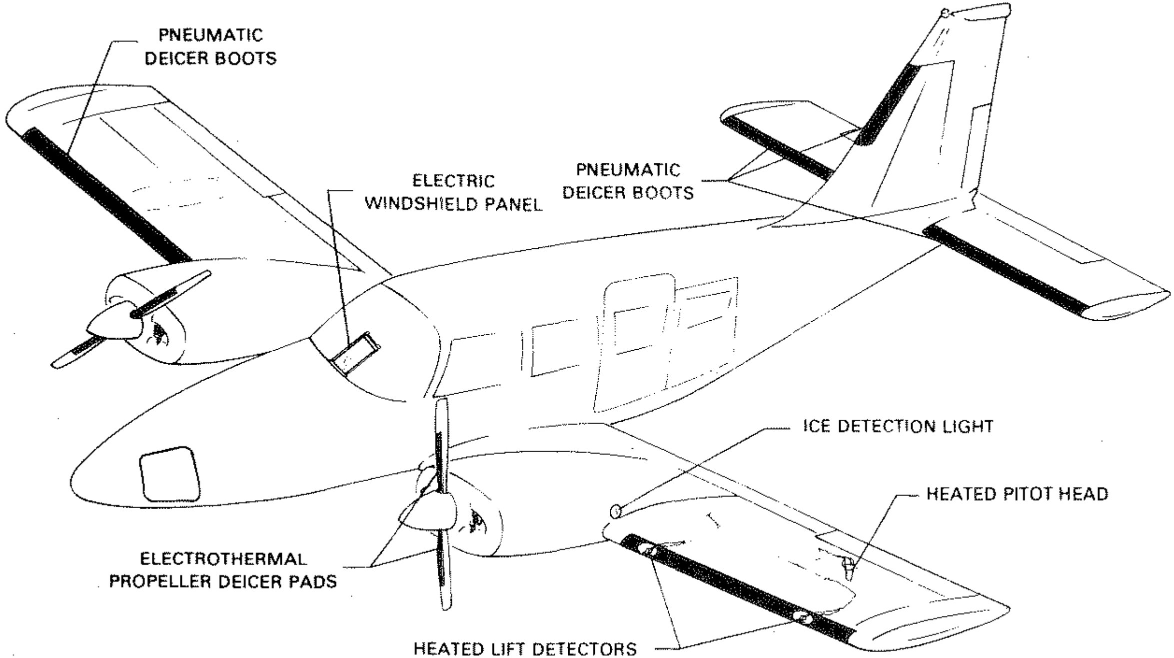
The complete ice protection system consists of the following components: pneumatic wing and empennage boots, wing ice detection light, electrothermal propeller deice pads, electric windshield panel, heated lift detectors, and heated pitot head. A single system or any combination of systems may be installed. However, the warning placard specified in Section 2 of this supplement is required. Such a placard is also required if any system is inoperative.

The pneumatic wing and empennage boots are installed on the leading edges of the wings, the vertical stabilizer and the horizontal stabilator. During normal operation, when the surface deicer system is off, the engine-driven pneumatic pumps apply a constant suction to the deicer boots to provide smooth, streamlined leading edges.

Deicer boots are inflated by a momentary ON type SURFACE DE-ICE switch (Figure 9-3) located on the instrument panel to the right of the control quadrant. Actuation of the surface deice switch activates a system cycle timer that energizes the pneumatic pressure control valves until the system pressure reaches 17 psi or until 6 seconds is reached. The boot solenoid valves are activated and air pressure is released to the boots, inflating all surface deicers on the airplane. A green indicator light illuminates when the wing-tail deicer surface boots are inflated above 8 psi. The light also incorporates a press-to-test and turn-to-dim feature. When the cycle is complete, the deicer solenoid valves permit automatic overboard exhaustion of pressurized air. Suction is then reapplied to the deicer boots. The deicer boots do not inflate during the press-to-test cycle.

Circuit protection for the surface deicer system is provided by a wing tail deice, W T DE-ICE, circuit breaker located on the circuit breaker panel.

Wing icing conditions may be detected during night flight by use of an ice detection light installed in the outboard side of the left engine nacelle. The light is controlled by a WING ICE LIGHT switch (Figure 9-3) located on the instrument panel to the right of the surface deice switch. A wing ice light, W/ICE, circuit breaker located in the circuit breaker panel provides circuit protection.



ICE PROTECTION SYSTEM
Figure 9-1

Electrothermal propeller deicer pads are bonded to the leading edges of the propeller blades. The system is controlled by an ON-OFF type PROP DE-ICE switch (Figure 9-3) located to the right of the surface deice switch. Power for the propeller deicers is supplied by the airplane's electrical system through a PROP DE-ICE circuit breaker in the circuit breaker panel. When the prop deice switch is actuated, power is applied to a timer through the PROP DE-ICER ammeter which monitors the current through the propeller deicing system. With the propeller deicing system on, the prop deicer ammeter needle should indicate within the shaded portion of the ammeter for a normal reading.

Power from the timer is cycled to brush assemblies which distribute power to slip rings. The current is then supplied from the slip rings directly to the electrothermal propeller deicer pads.

The Hartzell 2-blade propellers are deiced by heating the outboard half and then the inboard half of the deicer pads in a timer controlled sequence. The heating sequence of the deicer pads is conducted in the following order:

(a) Outboard halves of the propeller deicer pads on the right engine.
(b) Inboard halves of the propeller deicer pads on the right engine.
(c) Outboard halves of the propeller deicer pads on the left engine.
(d) Inboard halves of the propeller deicer pads on the left engine.

The optional McCauley 3-blade propellers are deiced by heating the entire deicer pads alternately in the following sequence:

(a) The entire deicer pads on the right engine for 90 seconds.
(b) The entire deicer pads on the left engine for 90 seconds.

When the system is turned ON, heating may begin on any one of the above steps, depending upon the positioning of the timer switch when the system was turned OFF from previous use. Once begun, cycling will proceed in the above sequence and will continue until the system is turned off.

A preflight check of the propeller deicers can be performed by turning the prop deice switch on and feeling the propeller deicer pads for proper heating sequence. The deicer pad should become warm to the touch.

The heat provided by the deicer pads reduces the adhesion between the ice and the propeller so that centrifugal force and the blast of airstream cause the ice to be thrown off the propeller blades in very small pieces.

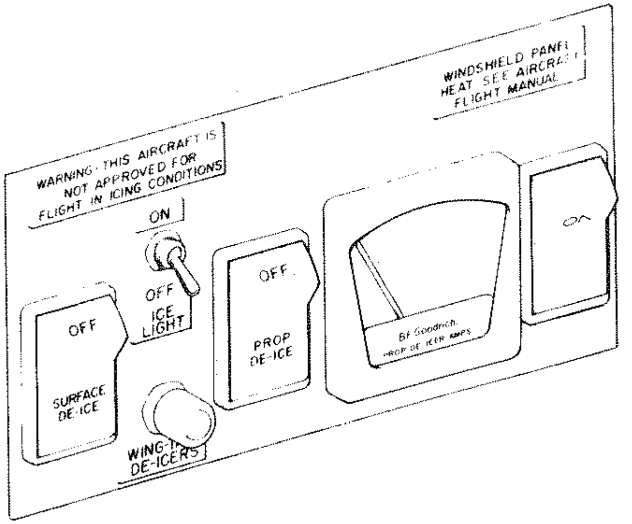
A heated glass panel is installed on the exterior of the pilot's windshield to provide visibility in icing conditions. The panel is heated by current from the airplane's electrical power supply and controlled by an ON-OFF control switch/circuit breaker. The control switch/circuit breaker is located in the right hand side of the deice panel and is placarded WINDSHIELD PANEL HEAT - SEE AIRPLANE FLIGHT MANUAL.

CAUTION

If the airplane is to be flown with the heated glass panel removed, rotate the receptacle plate 180° and replace it to cover the holes in the fuselage skin. Also replace the windshield collar screws.

An operational check may be performed by turning the heated windshield panel switch on for a period not exceeding 30 seconds. Proper operation is indicated by the glass section being warm to the touch.

Two heated lift detectors and a heated pitot head installed on the left wing are controlled by a single ON-OFF type PITOT HEAT switch located on the instrument panel below the pilot's control wheel.



ICE DETECTION LIGHT, SURFACE DEICER, PROPELLER DEICER AND HEATED WINDSHIELD CONTROL SWITCHES
Figure 9-3

The heated lift detectors, one inboard and one outboard on the left wing, are installed to prevent icing conditions from interfering with operation of the stall warning transmitters. A Stall Warn circuit breaker in the circuit breaker panel protects the system against an overvoltage condition. The stall warning system should not be depended on when there is ice on the wing.

A heated pitot head, mounted under the left wing, is installed to provide pitot pressure for the airspeed indicator with heat to alleviate ice accumulation from blocking the pressure intake. The heated pitot head also has a separate circuit breaker located in the circuit breaker panel and labeled Pitot Heat.

With the heated pitot switch on, check the heated pitot head and heated lift detector for proper heating.

CAUTION

Care should be taken when an operational check of the heated pitot head and the heated lift detectors is being performed. Both units become very hot. Ground operation should be limited to 3 minutes maximum to avoid damaging the heating elements.

SECTION 2 - LIMITATIONS

(a) Equipment required for flight into known or forecast icing:
   (1) Pneumatic wing and empennage boots.
   (2) Wing ice detection light.
   (3) Electrothermal propeller deice pads on the propeller blades.
   (4) Electrothermal windshield panel.
   (5) Heated lift detectors.
   (6) Heated pitot head.
   (7) Propeller spinners.

(b) If all the equipment listed above is not operative or not installed, the following placard must be installed in full view of the pilot.

WARNING - THIS AIRCRAFT IS NOT APPROVED FOR FLIGHT IN ICING CONDITIONS.

SECTION 3 - EMERGENCY PROCEDURES

The malfunction of any required deice equipment requires immediate action to avoid icing conditions.

ENGINE FAILURE IN ICING CONDITIONS

Select alternate air and attempt restart.
If unable to restart engine:
Inop. prop .... feather
Airspeed .... at or above 92 KIAS
Descend if necessary to maintain airspeed.
Electrical load .... reduce
Avoid further icing conditions if possible.
Land as soon as practical.
Maintain at least 89 KIAS on final.
Do not extend gear or lower flaps until certain of making field.
Flaps .... 25°

ALTERNATOR FAILURE IN ICING CONDITIONS

Alternator switches .... OFF then ON
Circuit breakers .... check and reset

If unable to restore alternator:
Avionics .... all off except Nav Comm and Transp.
Electric windshield .... OFF to maintain 65A load
If icing continues, terminate flight as soon as practical.

Prior to landing:
Electric windshield .... ON if necessary
Gear may require free fall extension.

WING-TAIL DEICER PANEL LIGHT

If light is illuminated more than 20 seconds pull surface deice circuit breaker.

SECTION 4 - NORMAL PROCEDURES

The Piper Seneca III is approved for flight into known icing conditions when equipped with the complete Piper Ice Protection System. Operating in icing conditions in excess of the Continuous Maximum and Intermittent Maximum as defined in FAR 25, Appendix C has been substantiated; however, there is no correlation between these conditions and forecasts of reported "Light, Moderate and Severe" conditions. Therefore, on the basis of flight tests, the following guidelines should be observed:

(a) Flight into severe icing is not approved.
(b) Moderate icing conditions above 10,000 ft. should be avoided whenever possible; if moderate icing conditions are encountered above 10,000 ft., a descent to a lower altitude should be initiated if practical.
(c) Operation in light icing is approved at all altitudes.

Icing conditions of any kind should be avoided whenever possible, since any minor malfunction which may occur is potentially more serious in icing conditions. Continuous attention of the pilot is required to monitor the rate of ice build-up in order to effect the boot cycle at the optimum time. Boots should be cycled when ice has built to between 1/4 and 1/2 inch thickness on the leading edge to assure proper ice removal. Repeated boot cycles at less than 1/4 inch can cause a cavity to form under the ice and prevent ice removal; boot cycles at thicknesses greater than 1/2 inch may also fail to remove ice.

Icing conditions can exist in any clouds when the temperature is below freezing; therefore it is necessary to closely monitor outside air temperature when flying in clouds or precipitation. Clouds which are dark and have sharply defined edges have high water content and should be avoided whenever possible. Freezing rain must always be avoided.

Prior to dispatch into forecast icing conditions all ice protection should be functionally checked for proper operation. Before entering probable icing conditions use the following procedures:

(a) Windshield defroster - ON (immediately)
(b) Pitot heat - ON (immediately)
(c) Windshield heat - ON (immediately)
(d) Propeller deice - ON (when entering icing conditions)
(e) Wing deice - ON (after 1/4 to 1/2 inch accumulation)
(f) Relieve propeller unbalance (if required) by increasing RPM briefly. Repeat as required.

WARNINGS

Do not cycle pneumatic boots with less than 1/4 inch of ice accumulation; operation of boots with less than 1/4 inch ice accumulation can result in failure to remove ice.

Do not hold momentary surface deice switch ON.

Heat for the lift detectors is activated by the pitot heat switch. When ice has accumulated on the unprotected surfaces of the airplane, aerodynamic buffet commences between 5 and 10 knots above the stall speed. A substantial margin of airspeed should be maintained above the normal stall speed, since the stall speed may increase by up to 10 knots in prolonged icing encounters.

If ice is remaining on the unprotected surfaces of the airplane at the termination of the flight, the landing should be made using full flaps and carrying a slight amount of power whenever practical, and approach speeds should be increased by 10 to 15 knots.

Cruise speed may be significantly reduced in prolonged icing encounters. If icing conditions are encountered at altitudes above 10,000 feet, it may be necessary to descend in order to maintain airspeed above the best rate of climb speed (92 KIAS).

NOTE

Pneumatic boots must be regularly cleaned and waxed for proper operation in icing conditions. Pitot, windshield and lift detector heat should be checked on the ground before dispatch into icing conditions.

SECTION 5 - PERFORMANCE

WARNING

Ice accumulation of the unprotected surfaces can result in significant performance loss.

Installation of ice protection equipment results in a 30 F.P.M. decrease in single engine climb performance and a reduction of 850 feet in single engine service ceiling.

All other performance is unchanged.

(8) Landing or missed approach
   a. Landing: Disengage AP and land.
   b. Missed Approach: Disengage AP and perform missed approach procedures per Airplane Flight Manual.

(k) BACK COURSE PROCEDURE
Same as front course except that BC is engaged after APPR is engaged and the airplane must be set for descent manually by holding the vertical trim control DN on the Mode Controller if in ALT hold or by establishing the desired PAH using CWS or vertical trim switch.

SECTION 5 - PERFORMANCE

No changes to the basic performance provided by Section 5 of this Pilot's Operating Handbook are necessary for this supplement.

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PILOT'S OPERATING HANDBOOK AND FAA APPROVED AIRPLANE FLIGHT MANUAL

SUPPLEMENT NO. 7 FOR PROPELLER SYNCHROPHASER INSTALLATION PIPER DWG. 36890

SECTION 1 - GENERAL

This supplement supplies information necessary for the operation of the airplane when the optional propeller synchrophaser is installed in accordance with "FAA Approved" Piper data. The information contained within this supplement is to be used in conjunction with the complete handbook.

This supplement has been "FAA Approved" and must remain in this handbook at all times when the optional propeller synchrophaser is installed.

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The function of the synchrophaser is to maintain both propellers at the same RPM and at a selected phase angle. This eliminates the propeller "beat" effect and minimizes vibration. When the synchrophaser is installed, the left engine is established as the master engine, and the right engine is equipped with a slave governor which automatically maintains its RPM with the left engine RPM. When the propeller synchrophaser is installed, a rotary switch is located on the throttle quadrant below the propeller controls. It is labeled OFF for manual control or standby and PHASE ADJUSTMENT for propeller synchronizing and phase angle adjustment.

SECTION 2 - LIMITATIONS

Placards:
On the throttle quadrant below engine and propeller controls:

USE OFF POSITION FOR TAKEOFF, LANDING AND SINGLE ENGINE OPERATIONS.

SECTION 3 - EMERGENCY PROCEDURES

The propeller synchrophaser must be in the OFF position for all single engine operations.

SECTION 4 - NORMAL PROCEDURES

The rotary switch must be in the OFF position during taxi, takeoff, landing and single engine operations. Before operating the synchrophaser system, ensure that the rotary switch is in the OFF position and manually synchronize the propellers to within 40 RPM. To operate, rotate the switch clockwise out of the OFF detent and slightly into the PHASE ADJUSTMENT range. It may require up to 30 seconds for the propellers to synchronize. The phase angle of the propellers may then be adjusted by rotating the switch within the PHASE ADJUSTMENT range to obtain the smoothest operation. Remember to wait 30 seconds after any switch movement for the propellers to assume the new phase angle. Turn the synchrophaser switch to the OFF position for 30 seconds before changing power settings; re-establish synchrophaser operation following power changes using the above procedure. Pulling the circuit breakers completely deactivates the propeller synchrophaser system. If the master switch is turned

OFF or if there is an electrical system failure, the slave engine will return to the controlled selected RPM plus approximately 25 RPM "out of synchronization" regardless of the position of the synchrophaser switch.

SECTION 5 - PERFORMANCE

No changes to the basic performance provided by Section 5 of this Pilot's Operating Handbook are necessary for this supplement.

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PILOT'S OPERATING HANDBOOK AND FAA APPROVED AIRPLANE FLIGHT MANUAL

SUPPLEMENT NO. 8 FOR BENDIX NP-2041A AREA NAVIGATION COMPUTER PROGRAMMER PIPER DWG. 39673

SECTION 1 - GENERAL

This supplement supplies information necessary for the operation of the airplane when the optional Bendix NP-2041A Area Navigation Computer Programmer is installed in accordance with "FAA Approved" Piper data. The information contained within this supplement is to be used in conjunction with the complete handbook.

This supplement has been "FAA Approved" and must remain in this handbook at all times when the optional Bendix NP-2041A Area Navigation Computer Programmer is installed.

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SECTION 2 - LIMITATIONS

No changes to the basic limitations provided by Section 2 of this Pilot's Operating Handbook are necessary for this supplement.

SECTION 3 - EMERGENCY PROCEDURES

No changes to the basic Emergency Procedures provided by Section 3 of this Pilot's Operating Handbook are necessary for this supplement.

SECTION 4 - NORMAL PROCEDURES

NOTE

The #1 VOR and DME receivers supply information to the NAV computer programmer, which in turn drives the pilot's navigation displays.

(a) Turn the VHF COM/NAV on and set the DME frequency pairing selector to N1.

(b) Turn the DME on.

(c) FREQUENCY SELECTION
  (1) MANUAL - Set KBD/NAV 1/COM 1 selector on COM/NAV to NAV 1. Set in frequency of the reference VOR/DME station.
  (2) KEYBOARD - Set KBD/NAV 1/ COM 1 selector on COM/NAV to KBD. Set in the frequency of VOR/DME station from the keyboard on the NP-2041A.

(d) Set the mode selector on the NP-2041A to VOR/LOC.

(e) Set the display selector on the NP-2041A to SBY.

(f) Address Standby Waypoint 1 by pressing the SBY WPT key and the #1 key.

(g) Program Waypoint 1 parameters (any sequence).

NOTE

Pressing the FREQ, BRG, DST, EL, or CRS keys causes a flashing dot to appear in the associated display window. A flashing dot indicates the parameter that is being addressed. As number keys corresponding to data are pressed, the numbers appear in the addressed window. If valid data is entered into the window, the flashing dot will extinguish when the ENTER key is pressed. If invalid data is entered in the window, the data will be rejected when the ENTER key is pressed and the window will revert to a flashing dot, which indicates data should be re-entered.

(1) STATION FREQUENCY - Press FREQ key; press number keys corresponding to the frequency of the VOR station; and press the ENTER key.
(2) WAYPOINT BEARING - Press BRG key; press number keys corresponding to the waypoint bearing; and press the ENTER key.
(3) WAYPOINT DISTANCE - Press DIST key; press number keys corresponding to the waypoint distance; and press the ENTER key.
(4) STATION ELEVATION - Press EL key; press number keys corresponding to the station elevation in hundreds of feet; and press the ENTER key.
(5) INBOUND AND OUTBOUND COURSE - Press CRS key; press number keys corresponding to the desired inbound or outbound course (depending upon whether IN or OUT annunciator lamp is illuminated); and press the ENTER key.

Press CRS XFR key; IN/OUT annunciator lamps will switch. Press CRS key, press number keys corresponding to the desired inbound or outbound course (as annunciated); and press the ENTER key.

(h) Repeat Step (f) and (g) for any (or all) of the remaining waypoints.

(i) Press SBY WPT key; press number key corresponding to the waypoint desired to be recalled from memory, and verify data.

(j) Set the display selector to BRG/DST.

(k) Press the WPT XFR key to transfer the standby waypoint to active.

NOTE

Provided the KBD/NAV 1/COM 1 selector on the COM/NAV unit is set to KBD, the NAV receiver and DME will be automatically tuned to the frequency stored for the active waypoint. The stored inbound course will be displayed in the CRS window for 30 seconds to allow the CRS control (OBS) on the IN-831 HSI to be set to that course. After the waypoint has been passed, the CRS XFR key can be pressed to recall the outbound course which will appear for 30 seconds to allow the CRS to be reset.

The course pointer on the In-881 HSI will automatically reset to the display course, provided its function switch is in the HSI position.

(l) With the mode selector set to VOR/LOC, the following data is displayed.
  (1) DISPLAY SELECTOR SET TO BRG/DST - Bearing and distance to the selected VOR/DME station are displayed.
  (2) DISPLAY SELECTOR SET TO KTS/TTS - Ground speed in knots and time-to-station are displayed in minutes.
  (3) HSI - The HSI presents unprocessed information with conventional angular sensitivity, i.e., full scale deviation equals 10° off course.
  (4) DISPLAY SELECTOR SET TO SBY - Data stored for standby waypoint (number appearing in SBY window) is displayed, and can be altered as desired.
  (5) DISPLAY SELECTOR SET TO ACT - Data stored for active waypoint (number in ACT display window) is displayed, but cannot be altered.

(m) With the mode selector set to RNAV, the following data is displayed.
   (1) DISPLAY SELECTOR SET TO BRG/DST - Bearing and distance to the selected waypoint is displayed.
   (2) DISPLAY SELECTOR SET TO KTS/TTS - Ground speed in knots and time-to-waypoint is displayed in minutes.
   (3) HSI - The HSI presents RNAV information with constant deviation, i.e., full scale deviation represents 5 nautical miles off course out to a distance of 100 nautical miles. From thereon full scale deviation represents 3° off course.
   (4) DISPLAY SELECTOR SET TO SBY - Data stored for stand-by waypoint (number appearing in SBY window) is displayed and can be altered as desired.
   (5) DISPLAY SELECTOR SET TO ACT - Data stored for active waypoint (number appearing in ACT window) is displayed, but cannot be altered.

(n) With the mode selector set to APR, the displays are the same as RNAV, except full scale deviation represents 1.25 nautical miles off course out to 25 nautical miles. From thereon, full scale deviation represents 3° off course.

(o) Program COM and NAV frequencies by performing the following steps.

NOTE

To program the COM/NAV Unit from the NP-2041A keyboard, the KBD/NAV/COM selector switches must be set to KBD.

   (1) MODE SELECTOR - The mode selector on the NP-2041A can be on in any position other than OFF or TEST to program COM 1 or COM 2 frequencies.
   (2) COM 1 FREQUENCY - Press COM 1 key; press number keys corresponding to the desired frequency; and press the ENTER key.
   (3) COM 2 FREQUENCY - Press COM 2 key; press number keys corresponding to the desired frequency; and press the ENTER key.

(4) NAV 1 FREQUENCY - Set the mode selector to VOR/LOC. (To tune NAV 1 from keyboard, mode selector must be set to VOR LOC.) Press NAV 1 key; press number keys corresponding to the desired frequency; and press the ENTER key.
(5) NAV 2 FREQUENCY - Press NAV 2 key; press number keys corresponding to the desired frequency; and press the ENTER key.

SECTION 5 - PERFORMANCE

No changes to the basic performance provided by Section 5 of the Pilot's Operating Handbook are necessary for this supplement.

PILOT'S OPERATING HANDBOOK AND FAA APPROVED AIRPLANE FLIGHT MANUAL

SUPPLEMENT NO. 9 FOR COLLINS ANS 351 AREA NAVIGATION COMPUTER PIPER DWG. 87292

SECTION 1 - GENERAL

This supplement supplies information necessary for the operation of the airplane when the optional Collins ANS 351 Area Navigation Computer is installed in accordance with "FAA Approved" Piper data. The information contained within this supplement is to be used in conjunction with the complete handbook.

This supplement has been "FAA Approved" and must remain in this handbook at all times when the optional Collins ANS 351 Area Navigation Computer is installed.

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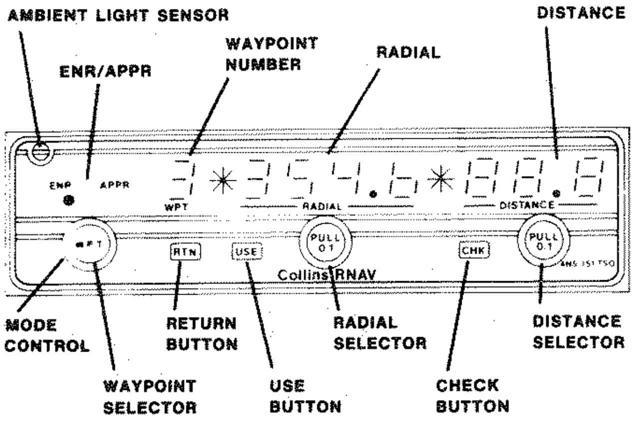
SECTION 2 - LIMITATIONS

No changes to the basic limitations provided by Section 2 of this Pilot's Operating Handbook are necessary for this supplement.

SECTION 3 - EMERGENCY PROCEDURES

No changes to the basic Emergency Procedures provided by Section 3 of this Pilot's Operating Handbook are necessary for this supplement.

SECTION 4 - NORMAL PROCEDURES



displays

ANS 351 AREA NAVIGATION COMPUTER,
CONTROLS AND INDICATORS

(a) CONTROLS

CONTROL OR INDICATOR	FUNCTION
Mode Control	Selects ENR (enroute) or APPR (approach) modes of operation. In the enroute mode, CDI deviation is 1 mile/dot, 5 miles full scale. In approach, CDI deflection is 1/4 mile/dot, 1-1/4 miles full scale.
Waypoint Selector	Sequences display waypoints from 1 through 8. Winking waypoint number indicates inactive waypoints; steadily-on-waypoint number indicates active waypoint.
Return Button	Depressing RTN (return) button returns the display to the active waypoint when an inactive waypoint is currently being displayed.
Use Button	Depressing the USE button converts the waypoint being displayed into the active waypoint.
Radial Selector	Two concentric knobs set radial information into the display. Knobs control information as follows: Large knob: Changes display in 10-degree increments. Small knob pushed in: Changes display in 1-degree increments. Small knob pulled out: Changes display in 0.1 degree increments.

CONTROL OR INDICATOR	FUNCTION
Distance Selector	Two concentric knobs set distance information in nautical miles into the display. Knobs control information as follows: Large knob: Changes display in 10-mile increments. Small knob pushed in: Changes display in 1-mile increments. Small knob pulled out: Changes display in 0.1-mile divisions from 00.0 through 100 miles. Beyond 100 nmi, changes display in 1-mile increments.
Check Button	Depressing CHK (check) button causes DME and bearing indicators to display raw distance and bearing information. RNAV computation, CDI deviation, to/from display, and autopilot tracking of RNAV path remain unaffected. The check button is spring-loaded to prevent permanent actuation.
Ambient Light Sensor	Automatically adjusts display lighting intensity as a function of cockpit ambient light.

(b) AREA NAVIGATION WAYPOINT PROGRAMMING

(1) Presetting of Waypoint On Ground

Waypoints are entered after engine start, since the waypoint information will probably be lost during the low-voltage condition occurring during engine cranking. Waypoint data should always be written in flight planning form to facilitate checking later in flight. When power is first applied to the ANS 351 and the system is in the RNAV mode, waypoint number 1 will be active, (waypoint number not blinking) and waypoint bearing and distance preset to zero will appear.

a. Waypoint number 1 coordinates are set into the ANS 351 using concentric knobs under bearing and distance display fields.

b. The waypoint selection knob is then rotated to select waypoint number 2. Note that the waypoint number is blinking, indicating that the waypoint is at this point inactive. Waypoint number 2 bearing and distance definitions are then set into the ANS 351.
c. Set up the rest of the desired waypoints as described above.
d. Press the RTN (return) pushbutton to display the active waypoint.

(2) Changing Waypoints In Flight
To change a waypoint in flight, rotate the waypoint selector until the desired waypoint number and coordinates are displayed on the ANS 351.
a. Verify that the waypoint definition is correct by comparing the display with the flight plan.
b. Uncouple the autopilot if tracking RNAV deviation.
c. Select the desired reference facility frequency on the associated NAV receiver.
d. Depress the USE pushbutton and note that the waypoint identification number stops winking.
e. Select the desired course on OBS.
f. Recouple the autopilot after deviation and distance-to-waypoint indications have stabilized.

SECTION 5 - PERFORMANCE

No changes to the basic performance provided by Section 5 of this Pilot's Operating Handbook are necessary for this supplement.

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PILOT'S OPERATING HANDBOOK AND FAA APPROVED AIRPLANE FLIGHT MANUAL

SUPPLEMENT NO. 10 FOR KING KNS 80 NAVIGATION SYSTEM PIPER DWG. 36978

SECTION 1 - GENERAL

This supplement supplies information necessary for the operation of the airplane when the optional King KNS 80 Navigation System is installed in accordance with "FAA Approved" Piper data. The information contained within this supplement is to be used in conjunction with the complete handbook.

This supplement has been "FAA Approved" and must remain in this handbook at all times when the optional King KNS 80 Navigation System is installed.

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SECTION 2 - LIMITATIONS

No changes to the basic limitations provided by Section 2 of this Pilot's Operating Handbook are necessary for this supplement.

SECTION 3 - EMERGENCY PROCEDURES

No changes to the basic Emergency Procedures provided by Section 3 of this Pilot's Operating Handbook are necessary for this supplement.

SECTION 4 - NORMAL PROCEDURES

(a) KNS 80 OPERATION

The KNS 80 can be operated in any one of 3 basic modes: (a) VOR, (b) RNAV, or (c) ILS. To change from one mode to another, the appropriate pushbutton switch is pressed, except that the ILS mode is entered automatically whenever an ILS frequency is channeled in the USE waypoint. The display will annunciate the mode by lighting a message above the pushbutton. In addition to the standard VOR and RNAV enroute (RNV ENR) modes, the KNS 80 has a constant course width or parallel VOR mode (VOR PAR) and an RNAV approach mode (RNV APR). To place the unit in either of these secondary modes the VOR pushbutton or the RNAV pushbutton, as the case may be, is pushed a second time. Repetitive pushing of the VOR button will cause the system to alternate between the VOR and VOR PAR modes, while repetitive pushing of the RNAV button causes the system to alternate between RNV ENR and RNV APR modes.

(b) CONTROLS

(1) VOR BUTTON

Momentary pushbutton.

When pushed while system is in either RNV mode causes system to go to VOR mode. Otherwise the button causes system to toggle between VOR and VOR PAR modes.

(2) RNAV BUTTON

Momentary pushbutton.

When pushed while system is in either VOR mode causes system to go to RNV ENR mode. Otherwise the button causes system to toggle between RNV ENR and RNV APR modes.

(3) HOLD BUTTON
Two position pushbutton.
When in depressed position, inhibits DME from channeling to a new station when the VOR frequency is changed. Pushing the button again releases the button and channels the DME to the station paired with the VOR station.

(4) USE BUTTON
Momentary pushbutton.
Causes active waypoint to take on same value as displayed waypoint and data display to go to FRQ mode.

(5) DSP BUTTON
Momentary pushbutton.
Causes displayed waypoint to increment by 1 and data display to go to frequency mode.

(6) DATA BUTTON
Momentary pushbutton.
Causes waypoint data display to change from FRQ to RAD to DST and back to FRQ.

(7) OFF/PULL ID CONTROL
   a. Rotate counterclockwise to switch off power to the KNS 80.
   b. Rotate clockwise to increase audio level.
   c. Pull switch out to hear VOR Ident.

(8) DATA INPUT CONTROL
Dual concentric knobs. Center knob has "in" and "out" positions.
   a. Frequency Data
      Outer knob varies 1 MHz digit.
      A carryover occurs from the units to tens position.
      Rollover occurs from 117 to 108 or vice versa.
      Center knob varies frequency in .05 MHz steps regardless of whether the switch is in its "in" or "out" position.

b. Radial Data
Outer knob varies 10 degree digit.
A carryover occurs from tens to hundreds position.
A rollover to zero occurs at 360 degrees.
Center knob "in" position varies 1 degree digit.
Center knob "out" position varies 0.1 degree digit.

c. Distance Data
Outer knob varies 10 NM digit.
A carryover occurs from the tens to hundreds place.
A rollover to zero occurs at 200 NM.
Center knob "in" position varies 1 NM digit.
Center knob "out" position varies 0.1 NM digit.

(9) COURSE SELECT KNOB
Located in CDI unit.
Selects desired course through the VOR ground station or waypoint.

SECTION 5 - PERFORMANCE

No changes to the basic performance provided by Section 5 of this Pilot's Operating Handbook are necessary for this supplement.

PILOT'S OPERATING HANDBOOK AND FAA APPROVED AIRPLANE FLIGHT MANUAL

SUPPLEMENT NO. 11 FOR KNS 81 DIGITAL AREA NAVIGATION SYSTEM PIPER DWG. 39810

SECTION 1 - GENERAL

This supplement supplies information necessary for the operation of the airplane when the optional KNS 81 Navigation System is installed in accordance with "FAA Approved" Piper data. The information contained within this supplement is to be used in conjunction with the complete handbook.

This supplement has been "FAA Approved" and must remain in this handbook at all times when the optional KNS 81 Navigation System is installed.

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SECTION 2 - LIMITATIONS

No changes to the basic limitations provided by Section 2 of this Pilot's Operating Handbook are necessary for this supplement.

SECTION 3 - EMERGENCY PROCEDURES

No changes to the basic Emergency Procedures provided by Section 3 of this Pilot's Operating Handbook are necessary for this supplement.

SECTION 4 - NORMAL PROCEDURES

(a) KNS 81 OPERATION
The KNS 81 can be operated in any one of 3 modes: (a) VOR, (b) RNAV, or (c) ILS. To change from one mode to another the mode select knob is rotated (large knob on the left side of the panel) except that the ILS mode is entered automatically whenever an ILS frequency is channeled. The display will annunciate the VOR or RNAV mode by lighting a message beside the waypoint. In addition to the standard VOR and RNAV enroute modes, the KNS 81 has a constant course width or parallel VOR mode (VOR PAR) and an RNAV approach mode (RNV APR). To place the unit in either of these secondary modes the mode selector knob is rotated.

(b) CONTROLS

(1) USE BUTTON
Momentary pushbutton.
Causes displayed waypoint to become active waypoint and "carrot" display to go to FRQ mode.

(2) RTN BUTTON
Momentary pushbutton.
When pushed causes waypoint in use to be displayed and "carrot" display to go to FRQ mode.

(3) RAD BUTTON
Two position pushbutton.
The KNS 81 is normally operated with the RAD button not pressed.
When in depressed position causes DME to display radial

information instead of ground speed. Radial displayed will be from the station in VOR mode and from the waypoint in RNAV modes.

(4) CHK BUTTON
Momentary pushbutton.
Causes radial and distance waypoint parameters to show radial and distance from VOR station instead.

(5) DATA BUTTON
Momentary pushbutton.
Causes waypoint data display to change from FRQ to RAD to DST and back to FRQ.

(6) OFF/ON/IDENT CONTROL
a. Power OFF-ON/Volume Function - Rotate clockwise for power ON.
b. VOR Audio Level Control - Rotate clockwise for increased audio level.
c. VOR IDENT Mute Function - Push-Pull switch. Enables the VOR Ident tone to be heard in out position.

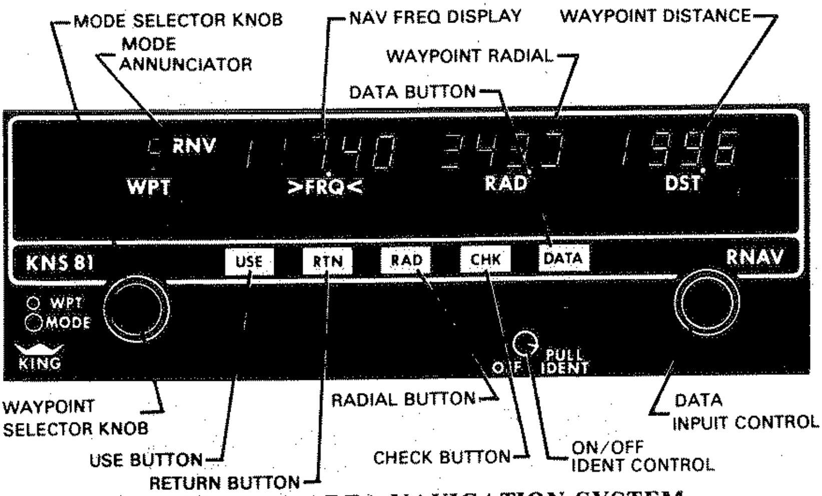
(7) DATA INPUT CONTROL
Dual concentric knobs, right side of panel - Center knob has "in" and "out" positions.
a. Frequency Data
Outer knob varies 1 MHz digit.
A carry occurs from units to tens position.
Rollover occurs from 117 to 108.
Center knob varies frequency in 50KHz steps ("IN" or "OUT" position).

b. Radial Data
Outer knob varies 10 degree digit.
A carry occurs from the tens to hundreds position.
A rollover to zero occurs at 360 degrees.
Center knob "in" position varies 1 degree digit.
Center knob "out" position varies 0.1 degree digit.

c. Distance Data
Outer knob varies 10NM digit.
A carry occurs from the tens to hundreds place.
A rollover to zero occurs at 200NM.
Center knob "in" position varies 1NM digit.
Center knob "out" position varies 0.1NM digit.

(8) DUAL CONCENTRIC KNOBS, LEFT SIDE OF PANEL
a. Mode Select
Outer knob changes mode from VOR to VOR PAR to RNV to RNV APR and rolls over.
b. WPT Select
Center knob selects waypoint from 1 to 9 and rolls over.

(9) COURSE SELECT KNOB
Located in remote unit.
Selects desired course through the VOR ground station or waypoint.



KNS 81 DIGITAL AREA NAVIGATION SYSTEM

SECTION 5 - PERFORMANCE

No changes to the basic performance provided by Section 5 of this Pilot's Operating Handbook are necessary for this supplement.

PILOT'S OPERATING HANDBOOK
AND
FAA APPROVED AIRPLANE FLIGHT MANUAL

SUPPLEMENT NO. 12
FOR
RCA COLOR WEATHERSCOUT II WEATHER RADAR SYSTEM

SECTION 1 - GENERAL

This supplement supplies information necessary for the operation of the airplane when the optional RCA Color WeatherScout II Weather Radar System is installed in accordance with "FAA Approved" Piper data. The information contained within this supplement is to be used in conjunction with the complete handbook.

This supplement has been "FAA Approved" and must remain in this handbook at all times when the optional RCA Color WeatherScout II Weather Radar System is installed.

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SECTION 2 - LIMITATIONS

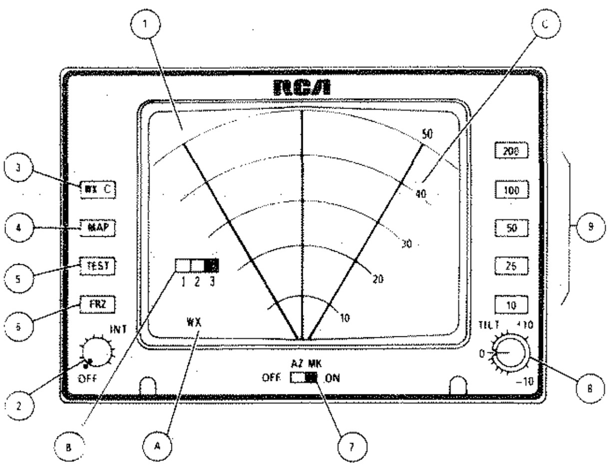
Do not operate the radar during refueling operations or in the vicinity of trucks or containers accommodating flammables or explosives. Do not allow personnel within 15 feet of area being scanned by antenna when system is transmitting.

SECTION 3 - EMERGENCY PROCEDURES

No changes to the basic Emergency Procedures provided by Section 3 of this Pilot's Operating Handbook are necessary for this supplement.

SECTION 4 - NORMAL PROCEDURES

(a) SYSTEM CONTROLS
All controls used to operate the radar system are located on the indicator front panel. These controls and the display features are indexed and identified in Figure 4-1 and described in Table 4-3.



INDICATOR CONTROLS AND DISPLAY FEATURES
Figure 4-1

(b) OPERATION

Preliminary Control Settings

Place the Indicator controls in the following positions before applying power from the aircraft electrical system:

INTensity control............. Fully counterclockwise, in OFF
TILT control................................ Fully upward
RANGE switch........................... 10 nautical miles

(1)	Display Area	See item A, B, and C for explanation of alphanumeric display.
	(A) Mode Field	Selected mode is displayed as WX, CYC, MAP, or TEST. STBY is displayed if R-T is warming up and no mode is selected after turn-on. WAIT is displayed if a mode is selected prior to end of warm up or when Indicator and Antenna are synchronizing.
	(B) Auxiliary Field	FRZ is displayed as a blinking word if radar is in freeze mode (to remind pilot that radar display is not being updated for incoming target returns). 1 2 3 and color bar legend is displayed in WX/C, TEST and MAP modes. In weather mode, color bar is green, yellow, and red. In map mode, color bar is cyan, yellow, and magenta.
	(C) Range Mark Identifiers	Five labeled range marks are displayed on each range. Label of furthest mark is same as range selected. Range and azimuth marks are displayed in cyan for WX/C and TEST, green for MAP.

INDICATOR CONTROLS AND DISPLAY FEATURES
Table 4-3

(2)	INT OFF	Rotary control used to regulate brightness (intensity) of display. On/Off function: Full CCW rotation of intensity control places system in OFF condition. CW rotation from OFF setting turns system on. STBY is displayed until WX/C, MAP, or TEST is selected. If WX/C or MAP is selected initially or prior to the end of the warm-up period, WAIT will be displayed until RT warms up (approximately 30 seconds). If TEST is selected immediately, WAIT will be displayed until Antenna is synchronized (less than 4 seconds and then test pattern will appear.
(3)	WX C	Alternate-action pushbutton switch used to select weather mode or cyclic contour mode. If selected at turn-on, system will come up in weather mode; second depression of switch will select cyclic contour mode.

INDICATOR CONTROLS AND DISPLAY FEATURES (cont)
Table 4-3 (cont)

		If selected when system is already operating in another mode, system will return to weather mode; second switch depression will select cyclic contour mode. In cyclic contour mode, 3-level (red) display will flash on and off at 1/2-second intervals.
(4)	MAP	Pushbutton switch used to select ground mapping mode.
(5)	TEST	Pushbutton switch used to select test mode. Special test pattern is displayed. In test, transmitter does not transmit and range is automatically 100 nm.
(6)	FRZ	Pushbutton switch used to select freeze mode. Radar display is not updated with incoming target return data. As a warning to the pilot, FRZ level will flash on and off at 1/2-second intervals.
(7)	AZ MK	Slide switch used to display three azimuth markers at 30 degree intervals.
(8)	TILT	Rotary control that enables pilot to select angles of antenna beam tilt with relation to airframe. Rotating control CW tilts beam upward; CCW rotation tilts beam downward.
(9)	10/25/50/100/ 200 (DI-1005)	Pushbutton switches used to select desired range. Five range marks are displayed for each range.

INDICATOR CONTROLS AND DISPLAY FEATURES (cont)
Table 4-3 (cont)

(c) OPERATING PRECAUTIONS

WARNING

Do not operate the radar during refueling operations or in the vicinity of trucks or containers accommodating flammables or explosives. Do not allow personnel within 15 feet of area being scanned by antenna when system is transmitting.

(1) Flash bulbs can be exploded by radar energy.
(2) Since storm patterns are never stationary, the display is constantly changing. Continued observation is always advisable in stormy areas.

SECTION 5 - PERFORMANCE

No changes to the basic performance provided by Section 5 of the Pilot's Operating Handbook are necessary for this supplement.

PILOT'S OPERATING HANDBOOK AND FAA APPROVED AIRPLANE FLIGHT MANUAL

SUPPLEMENT NO. 13 FOR RCA WEATHERSCOUT II WEATHER RADAR SYSTEM

SECTION 1 - GENERAL

This supplement supplies information necessary for the operation of the airplane when the optional RCA WeatherScout II Weather Radar System is installed in accordance with "FAA Approved" Piper data. The information contained within this supplement is to be used in conjunction with the complete handbook.

This supplement has been "FAA Approved" and must remain in this handbook at all times when the optional RCA WeatherScout II Weather Radar System is installed.

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SECTION 2 - LIMITATIONS

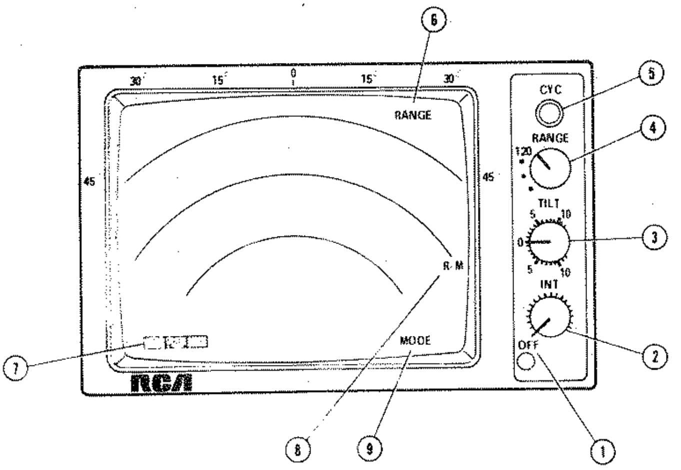
Do not operate the radar during refueling operations or in the vicinity of trucks or containers accommodating flammables or explosives. Do not allow personnel within 15 feet of area being scanned by antenna when system is transmitting.

SECTION 3 - EMERGENCY PROCEDURES

No changes to the basic Emergency Procedures provided by Section 3 of this Pilot's Operating Handbook are necessary for this supplement.

SECTION 4 - NORMAL PROCEDURES

(a) SYSTEM CONTROLS
All controls used to operate the radar system are located on the front panel. These controls and the display features are indexed and identified in Figure 4-1 and described in Table 4-3.



INDICATOR CONTROLS AND DISPLAY FEATURES
Figure 4-1

(1)	OFF	On/Off function: full CCW rotation of INTensity control places system in OFF condition.
(2)	INT	Rotary control used to regulate brightness (INTensity) of display.
(3)	TILT	Rotary control used to adjust antenna elevation position. Control indexes increments of tilt from 0 to 12 degrees up or down.
(4)	RANGE 12/30/60/90 or 12/30/60/120	Rotary switch used to select one of four ranges.
(5)	CYC	Pushbutton switch used to select cyclical contour mode. Data is presented alternately as normal for 0.5 seconds, then contoured for 0.5 seconds. Pressing switch a second time restores normal or WX mode.
(6)	Range Field	Maximum selected range is displayed. Maximum range is always displayed when indicator is in on-condition.
(7)	Test Field	Test block displays three illumination levels.
(8)	Range Mark Identifier	Individual label displayed for each range mark.
(9)	Mode Field	Operating mode is displayed as WX or CYC. When system is first turned on, WAIT is displayed until system times out (30-40 seconds).

INDICATOR CONTROLS AND DISPLAY FEATURES
Table 4-3

(b) PRELIMINARY CONTROL SETTINGS
Place the Indicator controls in the following positions before applying power from the aircraft electrical system:

INTensity control .... Fully counterclockwise, in OFF
TILT control .... Fully upward
RANGE switch .... 12 nautical miles

(c) OPERATIONAL CONTROL SETTINGS
(1) Rotate INTensity control clockwise to bring system into ON condition.
(2) Note that WAIT is displayed during warm-up period of 30-40 seconds.
(3) When WX is displayed, rotate INTensity control clockwise until display brightness is at desired level.
(4) Set RANGE switch to desired range.
(5) Adjust TILT control for desired forward scan area.

(d) PRECAUTIONS
If the radar is to be operated while the aircraft is on the ground:
(1) Direct nose of aircraft such that antenna scan sector is free of large metallic objects (hangars, other aircraft) for a distance of 100 yards (90 meters), and tilt antenna fully upward.

WARNING

Do not operate the radar during refueling operations or in the vicinity of trucks or containers accommodating flammables or explosives; do not allow personnel within 15 feet of area being scanned by antenna when system is transmitting.

(2) Flash bulbs can be exploded by radar energy.
(3) Since storm patterns are never stationary, the display is constantly changing, and continued observation is always advisable where areas of turbulence prevail.

SECTION 5 - PERFORMANCE

No changes to the basic performance provided by Section 5 of the Pilot's Operating Handbook are necessary for this supplement.

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PILOT'S OPERATING HANDBOOK AND FAA APPROVED AIRPLANE FLIGHT MANUAL

SUPPLEMENT NO. 14 FOR BENDIX RDR-160 MONOCHROME WEATHER RADAR SYSTEM

SECTION 1 - GENERAL

This supplement supplies information necessary for the operation of the airplane when the optional Bendix RDR-160 Monochrome Weather Radar System is installed in accordance with "FAA Approved" Piper data. The information contained within this supplement is to be used in conjunction with the complete handbook.

This supplement has been "FAA Approved" and must remain in this handbook at all times when the optional Bendix RDR-160 Monochrome Weather Radar System is installed.

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SECTION 2 - LIMITATIONS

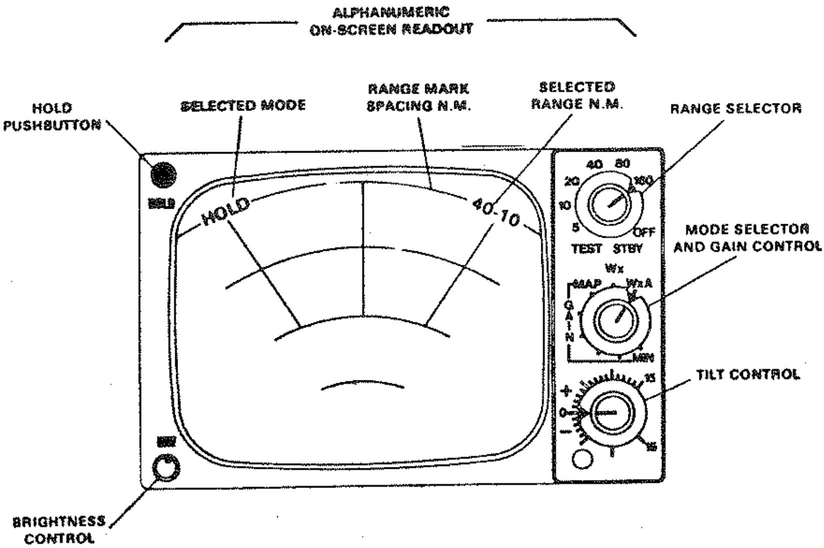
Do not operate the radar during refueling operations or in the vicinity of trucks or containers accommodating flammables or explosives. Do not allow personnel within 15 feet of area being scanned by antenna when system is transmitting.

SECTION 3 - EMERGENCY PROCEDURES

No changes to the basic Emergency Procedures provided by Section 3 of this Pilot's Operating Handbook are necessary for this supplement.

SECTION 4 - NORMAL PROCEDURES

(a) SYSTEM CONTROLS
Table 4-3 lists and describes the system controls, all of which are mounted on the panel of the radar indicator. Figure 4-1 illustrates the location of these controls. Table 4-5 lists the alphanumeric readouts of range - range marks and mode selection as a function of switch position.



LOCATION OF CONTROLS
Figure 4-1

CONTROL/ FUNCTION	OPERATIONAL USE
OFF/STBY/TEST Range Selector	1. Controls primary power to radar system. 2. Places system in "standby" condition during warmup period and when system is not in use. 3. Places system in "test" mode to determine operability of system. No transmission in "test" mode. 4. Selects operating range. Enables transmitter.
Wx/GAIN/Wx A Gain Control and Mode Selector	1. In Wx position, weather image gain is at preadjusted level. Contour operation is automatic and constant. 2. In GAIN position, 6 levels from MAP (maximum gain) to MIN may be selected for ground mapping operations. Contour operation is disabled. 3. In Wx A position, the radar indicator display alternately cycles between the Wx position and the GAIN MAP position. This will verify if a contour storm cell area is a storm cell and not a lake or some other terrain feature.

CONTROL FUNCTIONS AND OPERATION
Table 4-3

CONTROL/ FUNCTION	OPERATIONAL USE
HOLD Pushbutton Video Hold/ Scan	When the HOLD pushbutton is initially depressed, weather or ground mapping image last presented is retained (frozen) on indicator display in order to evaluate the significance of storm cell movement. Depressing for a second time reveals direction and distance of target movement during hold period. During HOLD mode, the antenna continues to scan and the display will continue to be presented as long as power is supplied to the system. The word HOLD will be flashing.
TILT Antenna Tilt Control	Electrically adjusts the antenna to move the radar beam to 15 degrees up or down from horizontal ("0" position).
BRT Brightness Control	Control CRT picture intensity.

CONTROL FUNCTIONS AND OPERATION (cont)
Table 4-3 (cont)

RADAR-160 WEATHER RADAR SYSTEM	
Range Switch Position	Range-Range Mark Readout
**TEST	40-10
5	5-1
10	10-2
20	20-4
40	40-10
80	80-20
160	160-40
Wx-MAP-Wx A Switch Position	Mode Readout*
Wx	Wx
MAP	MAP
WxA	WxA

*When the HOLD pushbutton is initially depressed, the MODE READOUT displays flashing HOLD.
**The MODE READOUT displays TEST.

ALPHANUMERIC READOUT
Table 4-5

(b) GENERAL OPERATING PRECAUTIONS

WARNING

Do not operate the radar during refuelling operations or in the vicinity of trucks or containers accommoding flammables or explosives; do not allow personnel within 15 feet of area being scanned by antenna when system is transmitting.

(1) Flash bulbs can be exploded by radar energy.
(2) Since storm patterns are never stationary, the display is constantly changing, and continued observation is always advisable where areas of turbulence prevail.

NOTE

See RDR-160 pilot manual for detailed operating information and analysis of targets.

SECTION 5 - PERFORMANCE

No changes to the basic performance provided by Section 5 of the Pilot's Operating Handbook are necessary for this supplement.

PILOT'S OPERATING HANDBOOK
AND
FAA APPROVED AIRPLANE FLIGHT MANUAL

SUPPLEMENT NO. 15
FOR
BENDIX RDR-160/IN-2026A COLOR WEATHER RADAR SYSTEM

SECTION 1 - GENERAL

This supplement supplies information necessary for the operation of the airplane when the optional Bendix RDR-160/IN-2026A Color Weather Radar System is installed in accordance with "FAA Approved" Piper data. The information contained within this supplement is to be used in conjunction with the complete handbook.

This supplement has been "FAA Approved" and must remain in this handbook at all times when the optional Bendix RDR-160/IN-2026A Color Weather Radar System is installed.

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SECTION 2 - LIMITATIONS

Do not operate the radar during refueling operations or in the vicinity of trucks or containers accommodating flammables or explosives. Do not allow personnel within 15 feet of area being scanned by antenna when system is transmitting.

SECTION 3 - EMERGENCY PROCEDURES

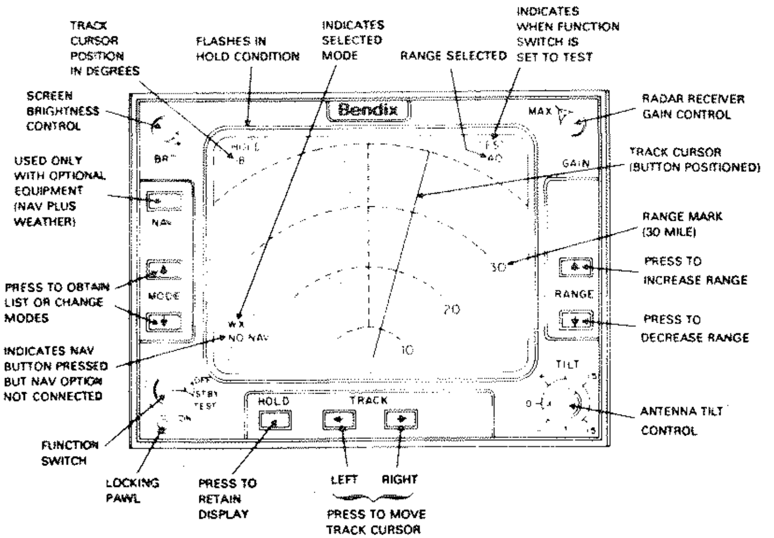
No changes to the basic Emergency Procedures provided by Section 3 of this Pilot's Operating Handbook are necessary for this supplement.

SECTION 4 - NORMAL PROCEDURES

(a) EQUIPMENT OPERATION AND CONTROLS

(1) RDR-160/IN-2026A CONTROLS AND DISPLAYS

Controls and displays for the RDR-160/IN-2026A Color Weather Radar System are listed in Table 4-3, with a functional description. Location of the controls and displays is shown in Figure 4-1. All operating controls and displays are located on the indicator.



IN-2026A CONTROLS AND DISPLAYS
Figure 4-1

CONTROL DISPLAY	FUNCTION
Function selector	1. OFF position removes primary power from the system. 2. STBY position places system in the standby condition during warm-up period and when the system is not in use. No display. 3. TEST position selects test function to determine operability of the system. A test pattern is displayed. NO transmission exists in the TEST condition. 4. ON position selects the condition for normal operation. Radar transmission exists in the ON position.
[⍋] RANGE button	Clears the display and places the indicator in the next lower range each time the button is pressed (eg: 40 to 20), until minimum range is reached.
TILT control	Electrically adjusts the antenna to move the radar beam up to +15 degrees above the horizontal, or to a maximum of -15 degrees below the horizontal position. The horizontal position is indicated as zero degrees on the control.
TRACK [➛] button	When pressed, a yellow track cursor line appears and moves to the right (in one degree steps) while the button is held depressed. The track cursor stops when the button is released, and remains for about 10 to 15 seconds, then disappears unless the button is pressed again. The differential heading will be indicated in yellow numerals in the upper left corner of the display, and disappears simultaneously with the track cursor.

CONTROL/DISPLAY FUNCTIONS
Table 4-3

CONTROL/ DISPLAY	FUNCTION
TRACK [←] button	When pressed, the yellow track cursor appears and moves to the left while held depressed. Operation is as explained above.
GAIN control	Varies the radar receiver gain when in the MAP mode. Gain and the STC are preset in TEST function and in the WX and WXA modes.
BRT control	Adjusts brightness of the display for varying cockpit light conditions.
[▲] MODE button	Pressing momentarily produces an "information list" on the display. Pressing again, while information display is still present, advances the indicator display to the next higher mode shown on the list. The list disappears after a few seconds and the mode does not change if the button is not pressed again. The following standard modes are available in the order shown. NAV FLT LOG - Functions available with optional IU-2023A. MAP - Ground mapping WXA - Weather mapping with alert. The red area flashes. WX - Weather mapping NOTE: When the top mode is reached, the button will not change the mode.
[▼] MODE button	Moves the indicator display to the next lower mode each time the button is pressed while the list is present. The sequence is as listed above. NOTE: When the bottom mode (WX) is reached, this button will not change the mode.

CONTROL/DISPLAY FUNCTIONS (cont)
Table 4-3 (cont)

CONTROL DISPLAY	FUNCTION
NAV button (push-on push-off)	Operational only when optional IU-2023A Remote Computer Unit is connected. When actuated, provides NAV information superimposed over the MODE selected (WX, WXA, or MAP). If interface is not connected, the words NO NAV will be displayed in the lower left corner.
[▲] RANGE button	Clears the display and advances the indicator to the next higher range each time the button is pressed (eg: 20 to 40, 40 to 80, etc.), until 160 mile range is reached. The range selected is displayed in the upper right corner (on the last range mark), and the distance to each of the other range marks circles is displayed along the right edge of the circles (arcs).
HOLD pushbutton (push-on push-off)	Retains the display (NAV and weather) when button is actuated (push-on). The word HOLD flashes in the upper left corner of the display. The weather or ground mapping image last presented is retained (frozen) on indicator display in order to evaluate the significance of storm cell movement. Switching back to normal operation (pressing HOLD pushbutton a second time) reveals direction and distance of target movement during HOLD period. In HOLD, the antenna continues to scan and a non-updated display will continue to be presented as long as power is supplied to the system. A change in range selection, with indicator in HOLD results in a blank screen.

CONTROL/DISPLAY FUNCTIONS (cont)
Table 4-3 (cont)

(b) OPERATING PRECAUTIONS

WARNING

Do not operate the radar during refueling operations or in the vicinity of trucks or containers accommoding flammables or explosives. Do not allow personnel within 15 feet of area being scanned by antenna when system is transmitting.

(1) Flash bulbs can be exploded by radar energy.
(2) Since storm patterns are never stationary, the display is constantly changing. Continued observation is always advisable in stormy areas.

SECTION 5 - PERFORMANCE

No changes to the basic performance provided by Section 5 of the Pilot's Operating Handbook are necessary for this supplement.

PILOT'S OPERATING HANDBOOK
AND
FAA APPROVED AIRPLANE FLIGHT MANUAL

SUPPLEMENT NO. 16
FOR
PROPELLER SYNCHROPHASER INSTALLATION
PIPER DWG. 87719

SECTION 1 - GENERAL

This supplement supplies information necessary for the operation of the airplane when the optional propeller synchrophaser is installed in accordance with "FAA Approved" Piper data. The information contained within this supplement is to be used in conjunction with the complete handbook.

This supplement has been "FAA Approved" and must remain in this handbook at all times when the optional propeller synchrophaser is installed.

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The function of the synchrophaser is to maintain both propellers at the same RPM and at a selected phase angle. This eliminates the propeller "beat" effect and minimizes vibration. When the synchrophaser is installed, the left engine is established as the master engine, and the right engine is equipped with a slave governor which automatically maintains its RPM with the left engine RPM. When the propeller synchrophaser is installed, a three-position switch is located on the throttle quadrant below the propeller controls. It is labeled OFF for manual control and "1" or "2" for propeller synchrophaser. A blue "press to test" light which illuminates when the propellers are out of synchronization is located below the switch.

SECTION 2 - LIMITATIONS

Placards:

On the throttle quadrant below engine and propeller controls:

USE OFF POSITION FOR TAKEOFF, LANDING AND SINGLE ENGINE OPERATIONS.

SECTION 3 - EMERGENCY PROCEDURES

The propeller synchrophaser must be in the OFF position for all single engine operations.

SECTION 4 - NORMAL PROCEDURES

During taxi, takeoff, landing or single engine operations the propeller synchrophaser switch should be in the "OFF" position. The blue "press to test" light below the switch will illuminate while the propellers are out of synchronization, whether the switch is in the "OFF," "1," or "2" position. When the switch is in the "OFF" position the propellers can be synchronized manually and the light will go out when propeller synchronization is complete. For automatic synchronization, the propellers should be synchronized manually to within approximately 10 RPM and the switch placed in the "1" position. The blue light will go out when synchronization is complete. For a given RPM and power setting, switch position "2" may provide smoother operation by means of providing a different phase angle. Set the switch to position "1" or "2," whichever provides the smoothest operation. Normally, propeller synchrophasing will take place within a

few seconds, but occasionally it may take up to a full minute. When the power setting is to be changed, the synchrophaser switch should be set to "OFF" for 30 seconds before the power setting is adjusted; then the synchrophaser switch may be returned to the "1" or "2" position, whichever provides the smoothest operation. If the propeller RPM differential exceeds 50 RPM, the switch should be set at "OFF" for 30 to 40 seconds; then the propellers can be synchronized again and the synchrophaser switch returned to "1" or "2." Pulling the circuit breakers completely deactives the propeller synchrophaser system. If the master switch is turned "OFF" or if there is an electrical system failure, the slave engine will return to the controlled selected RPM plus approximately 25 RPM "out of synchronization" regardless of the position of the synchrophaser switch.

SECTION 5 - PERFORMANCE

No changes to the basic performance provided by Section 5 of this Pilot's Operating Handbook are necessary for this supplement.

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SUPPLEMENT 17

CENTURY 21 AUTOPILOT INSTALLATION

SECTION 1 - GENERAL

This supplement supplies information necessary for the operation of the airplane when the optional Century 21 Autopilot is installed in accordance with STC SA3384SW-D. The information contained within this supplement is to be used in conjunction with the complete handbook.

This supplement has been "FAA Approved" as a permanent part of this handbook and must remain in this handbook at all times when the optional Century 21 Autopilot is installed.

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SECTION 2 - LIMITATIONS

(a) Maximum airspeed for autopilot operation is 180 KIAS. (Autopilot V_{MO})
(b) Autopilot OFF during takeoff and landing.
(c) Autopilot coupled approaches prohibited with more than one notch (10°) flap extended.

SECTION 3 - EMERGENCY PROCEDURES

(a) AUTOPILOT

In the event of an autopilot malfunction, or anytime the autopilot is not performing as commanded, do not attempt to identify the problem. Regain control of the aircraft by overpowering and immediately disconnecting the autopilot by depressing the AP ON-OFF switch on the programmer OFF, or by pulling the autopilot circuit breaker.

Do not operate until the system failure has been identified and corrected.

(1) Altitude Loss During Malfunction:

a. An autopilot malfunction during climb, cruise or descent with a 3 second delay in recovery initiation could result in as much as 60° of bank and 300′ altitude loss. Maximum altitude loss was recorded at 180 KIAS during descent at high altitude.

b. An autopilot malfunction during an approach with a 1 second delay in recovery initiation could result in as much as 30° bank and 100′ altitude loss. Maximum altitude loss measured with one notch (10 degrees) flap, gear down, and operating either coupled or uncoupled, single or multi-engine.

(b) COMPASS SYSTEM

(1) Emergency Operation with Optional NSD 360A (HSI) Slaved and/or Non-Slaved:

NSD 360A

a. Appearance of HDG Flag:

1. Check air supply gauge (vac or pressure) for adequate air supply (4 in. Hg. min.).

2. Check compass circuit breaker.
3. Observe display for proper operation.

b. To disable heading card - pull circuit breaker and use magnetic compass for directional data.

NOTE

If heading card is not operational, autopilot should not be used.

c. With card disabled VOR/Localizer and Glide Slope displays are still functional: use card set to rotate card to aircraft heading for correct picture.
d. Slaving Failure - (i.e. failure to self correct for gyro drift):
   1. Check gyro slaving switch is set to No. 1 position (if equipped with Slave No. 1 - No. 2 switch) or "Slaved" position when equipped with Slaved and Free Gyro Mode Switch.
   2. Check for HDG Flag.
   3. Check compass circuit breaker.
   4. Reset heading card while observing slaving meter.

NOTE

Dead slaving meter needle or a needle displaced fully one direction indicates a slaving system failure.

   5. Select slaving amplifier No. 2, if equipped. If not equipped, proceed with No. 7 below.
   6. Reset heading card while checking slaving meter. If proper slaving indication is not obtained, proceed with No. 7 below.
   7. Switch to free gyro mode and periodically set card as an unslaved gyro.

NOTE

In the localizer mode, the "TO'FROM" arrows may remain out of view, depending upon the design of the NAV converter used in the installation.

SECTION 4 - NORMAL PROCEDURES

Refer to Edo-Aire Mitchell Century 21 Autopilot Operator's Manual, P/N 68S805, dated 1-79 for Autopilot Description and Normal Operating Procedures.

(a) PREFLIGHT PROCEDURES

NOTE

During system functional check the system must be provided adequate D.C. voltage (12.0 VDC min.) and instrument air (4.2 in. Hg. min.). It is recommended that one engine be operated (minimum) to provide the necessary power and that the aircraft be positioned in a level attitude, during the functional check.

(b) AUTOPILOT WITH STANDARD D.G.
  (1) Engage autopilot by pushing programmer OFF-ON switch ON.
  (2) Rotate D.G. HDG bug left then right and verify that control wheel movement corresponds to HDG command input.
  (3) Grasp control wheel and override roll servo actuator to assure override capability.
  (4) With HDG bug centered select NAV or APPR mode and note control wheel movement toward VOR needle offset.
  (5) Select REV mode and note control wheel movement opposite VOR needle offset.
  (6) Disengage autopilot.
  (7) Check aileron controls through full travel to assure complete autopilot disengagement.

(c) AUTOPILOT WITH COMPASS SYSTEM (NSD 360A)
(For other compass systems, refer to appropriate manufacturer's instructions)
  (1) Check slaving switch in slave or slave 1 or 2 position, as appropriate. (Slaving systems with R.M.I. output provide only slave and free gyro positions.)
  (2) Rotate card to center slaving meter - check HDG displayed with magnetic compass HDG.
  (3) Perform standard VOR receiver check.

(4) Perform Steps (1) - (7) in Section 4 item (b) except in Steps (4) and (5) substitute course arrow for HDG bug when checking control wheel movement in relation to L/R needle. HDG bug is inoperative with NAV, APPR, or REV mode selected.

(d) IN-FLIGHT PROCEDURE

(1) Rotate heading bug to desired heading.
(2) Trim aircraft for existing flight condition (all axes). Engage autopilot.
(3) During maneuvering flight - control aircraft through use of the HDG bug. (HDG mode)
(4) For navigation operations select modes as required by the operation being conducted and in accordance with the mode description provided in Operator's Manual. For specific instructions relating to coupled instrument approach operations, refer to Special Operations and Information Section.

(e) SPECIAL OPERATIONS AND INFORMATION

(1) Instrument Approach Operations
Initial and/or intermediate approach segments should be conducted at approximately 95 - 110 KIAS with a maximum of 1 notch (10°) flaps extended as desired. Upon intercepting the glide path or when passing the final approach fix (FAF) immediately lower the landing gear and reduce the power for approximately 90 - 95 KIAS on the final approach segment. Monitor course guidance information (raw data) throughout the approach. All power changes should be of small magnitude and smoothly applied for best tracking performance. Do not change aircraft configuration during approach while autopilot is engaged.

SECTION 5 - PERFORMANCE

No changes to the basic performance provided by Section 5 of this Pilot's Operating Handbook are necessary for this supplement.

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SUPPLEMENT 18

CENTURY 41 AUTOPILOT INSTALLATION

SECTION 1 - GENERAL

This supplement supplies information necessary for the operation of the airplane when the optional Century 41 Autopilot Mode AK865 or Century 41 Flight Director Autopilot Mode AK881/FD is installed in accordance with STC SA3371SW-D. The information contained within this supplement is to be used in conjunction with the complete handbook.

This supplement has been "FAA Approved" as a permanent part of this handbook and must remain in this handbook at all times when the optional Century 41 Autopilot or Century 41 Flight Director Autopilot is installed.

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SECTION 2 - LIMITATIONS

(a) Autopilot use prohibited above 180 KIAS. (Autopilot V_{MO})
(b) Autopilot OFF during takeoff and landing.
(c) Required Placard, P/N 13A990 stating "Conduct trim check prior to first flight of day - (See AFM)" to be installed in clear view of pilot.
(d) Autopilot coupled Go-Around maneuvers prohibited [See Section 4 item (a)].
(e) Category 1 operations only.

SECTION 3 - EMERGENCY PROCEDURES

(a) AUTOPILOT
In the event of an autopilot malfunction, or anytime the autopilot is not performing as commanded, do not attempt to identify the problem system. Regain control by overpowering and immediately disconnecting the autopilot. This will disable both the autotrim system and the autopilot system. If the malfunction was in the autotrim system there may be residual control wheel force after the system is OFF. Be prepared for any residual trim force and retrim, as necessary, using the aircraft's primary trim control system.

NOTE

Do not overpower autopilot in pitch for more than approximately 3 seconds as the autotrim system will cause an increase in pitch overpower forces.

(1) Autopilot may be disconnected by:
  a. Depressing "AP OFF" bar on pilot's trim switch.
  b. Depressing the AP ON-OFF switch on the programmer.
  c. Depressing master disconnect switch on pilot's control wheel.
(2) Autotrim may be disconnected by:
  a. Depressing the autopilot ON-OFF switch - OFF.
  b. Placing the autotrim master switch - OFF.
  c. Depressing master disconnect switch on pilot's control wheel.

After failed system has been identified, pull system circuit breaker and do not operate until the system has been corrected.

(3) Single Engine Operations:

a. Engine failure during an autopilot approach operation: Disengage autopilot, conduct remainder of approach manually.

b. Engine failure during normal climb, cruise, descent: Retrim aircraft, perform normal aircraft engine out procedures.

c. Maintain aircraft yaw trim throughout all single engine operations.

NOTE

Single engine operations below Single Engine Best Rate of Climb Speed (Blue Line) may require manual rudder application to maintain directional trim depending upon aircraft configuration and power applied.

(4) Altitude Loss During Malfunction:

a. An autopilot malfunction during climb, cruise or descent with a 3 second delay in recovery initiation could result in as much as 60° bank and 700′ altitude loss. Maximum altitude loss measured at 180 KIAS during descent at high altitude.

b. An autopilot malfunction during an approach with one second delay in recovery initiation could result in as much as 30° bank and 100′ altitude loss. Maximum altitude loss measured with one notch (10 degrees) flaps, gear down, and operating either coupled or uncoupled, single or multi-engine.

(b) COMPASS SYSTEM

(1) Emergency Operation with Optional NSD 360A (HSI) Slaved and/or Non-Slaved:

NSD 360A

a. Appearance of HDG Flag:

1. Check air supply gauge (vac or pressure) for adequate air supply (4 in. Hg. min.).
2. Check compass circuit breaker.
3. Observe display for proper operation.

b. To disable heading card - pull circuit breaker and use magnetic compass for directional data.

NOTE

If heading card is not operational, autopilot should not be used.

c. With card disabled VOR/Localizer and Glide Slope displays are still functional; use card set to rotate card to aircraft heading for correct picture.
d. Slaving Failure - (i.e. failure to self correct for gyro drift):
   1. Check gyro slaving switch is set to No. 1 position (if equipped with Slave No. 1 - No. 2 switch) or "Slaved" position when equipped with Slaved and Free Gyro Mode Switch.
   2. Check for HDG Flag.
   3. Check compass circuit breaker.
   4. Reset heading card while observing slaving meter.

NOTE

Dead slaving meter needle or a needle displaced fully one direction indicates a slaving system failure.

   5. Select slaving amplifier No. 2, if equipped. If not equipped, proceed with No. 7 below.
   6. Reset heading card while checking slaving meter. If proper slaving indication is not obtained, proceed with No. 7 below.
   7. Switch to free gyro mode and periodically set card as an unslaved gyro.

NOTE

In the localizer mode, the "TO'FROM" arrows may remain out of view, depending upon the design of the NAV converter used in the installation.

SECTION 4 - NORMAL PROCEDURES

(a) NORMAL OPERATING PROCEDURES

NOTE

This autopilot is equipped with an A/P "OFF" warning horn that will sound for approximately 4 seconds anytime the autopilot is disengaged. This will be accompainied by an "A/P" message flash on the autopilot remote annunciator for approximately 5 seconds.

The horn may be silenced before the 4 second time limit is up by:
(1) Pressing "T" bar atop command trim switch,
(2) by re-engaging the autopilot.

NOTE

If this autopilot is equipped with a Flight Director steering horizon the F/D must be switched on before the autopilot may be engaged. Any autopilot mode may be preselected and will be retained upon autopilot engagement.

CAUTIONS

Flight Director Autopilot versions only are equipped with a remote go-around switch. When G/A mode is selected the AUTOPILOT WILL DISCONNECT and warning horn will sound. Pilot may use Flight Director steering for missed approach guidance. After aircraft is stabilized in a proper climb with gear and flaps up, the autopilot may be re-engaged and will retain G/A mode. Autopilot only (no Flight Director) versions do not have a G/A switch.

If glide slope coupling is not desired while operating on the localizer use NAV or REV mode instead of APPR mode.

CAUTION

Refer to Edo-Aire Mitchell Century 41 Operator's Manual, P/N 68S803, dated 1-79 for additional System Description and Normal Operating Procedures.

(b) PREFLIGHT PROCEDURES

NOTE

During system functional check the system must be provided adequate D.C. voltage (12.0 VDC min.) and instrument air (4.2 in. Hg. min.). It is recommended that one engine be operating (minimum) to provide the necessary power and that the aircraft be positioned in a level attitude, during the functional check.

(1) AUTOPILOT (F/D Switch ON if F/D Equipped)
   a. Engage autopilot by pushing programmer OFF - ON switch ON.
   b. Rotate D.G. HDG bug left then right and verify that control wheel movement corresponds to HDG command input.
   c. Press pitch modifier button first up then down and note that pitch control follows pitch command input. Autotrim should follow pitch command input after approximately three second delay.
   d. Grasp control wheel and override roll and pitch servo actuators to assure override capability.
   e. Hold control yoke and disengage autopilot by activating the control wheel trim switch.
   f. Check controls through full travel in roll and pitch to assure complete autopilot disengagement.
   g. Retrim aircraft for takeoff.

(c) TRIM SYSTEM

The autopilot is provided with an electric elevator trim system having two modes of operation. When the autopilot is engaged and the trim master switch is ON, automatic electric trim (autotrim) is provided. When the autopilot is disengaged, command electric elevator trim is available by use of the control wheel switch provided or by use of the primary trim control wheel. The electric elevator trim system has been designed to withstand any type of single failure, either mechanical or electrical, without uncontrolled operation resulting. The automated system self test circuit provided, in conjunction with a functional check, described below, will uncover internal failures that otherwise could remain undetected and thus compromise the fail-safe properties of the system. Proper operation of the system is, therefore, predicated on conducting the following preflight check first flight of each day. If the trim system fails any portion of this test, turn the trim switch OFF and pull the trim circuit breaker, until the system is corrected.

The command electric trim switch on the left portion of the pilot's control wheel has two functions:

(1) When the top bar (AP OFF) is pressed, it disconnects the autopilot.
(2) When the top bar is pressed and the rocker is moved forward, nose down trim will occur; when moved aft, nose up trim will occur.

Command Trim - Before the First Flight of Each Day

(1) Trim master switch - ON.
(2) Verify normal trim UP and DOWN operation with control wheel switch.
(3) Press - center bar only - then release center bar.
(4) Push rocker fore and aft - only. Trim should not operate with either separate action.

Any failure of the preceding operations indicates that a failure exists in the system and the Command Trim shall not be operated until the failure has been identified and corrected.

Autotrim - Before the First Flight of Each Day

(1) Check trim master switch ON, autopilot OFF.

(2) Press and hold TEST pushbutton on Mode Annunciator. Verify the following sequence. (Each sequence will last approximately two seconds):

a. All annunciations light with FAIL and AP flashing.

b. Autotrim flashes, goes steady, then flashes.

c. All lights go steady.

d. After three to five seconds, AUTOTRIM and FAIL flash continually.

(3) With TEST button on the Mode Annunciator still depressed, verify Trim will not operate in either direction with the Control Wheel Switch.

(4) Release TEST pushbutton. All lights except HDG and ATT shall extinguish.

Any deviation from the above sequence indicates that a failure exists in either the primary system or in the monitor circuits. The autopilot and trim system shall not be operated until the failure has been identified and corrected.

CAUTION

Recheck trim position prior to initiating takeoff.

(d) FLIGHT DIRECTOR

(1) Check circuit breaker - IN.

(2) Flight director switch on steering horizon - ON. (Adjacent to instrument on single cue horizon)

(3) Pitch modifier DN-UP - check pitch steering indicator moves appropriately.

(4) HDG bug RT-LT - check roll steering indicator moves appropriately.

(e) COMPASS SYSTEM (NSD 360A)
(For other compass systems, refer to appropriate manufacturer's instructions)
(1) Check slaving switch in slave or slave 1 or 2 position, as appropriate. (Slaving systems with R.M.I. output provide only slave and free gyro positions.)
(2) Rotate card to center slaving meter - check HDG displayed with magentic compass HDG.
(3) Perform standard VOR receiver check.
(4) NAV-APPR - Engage NAV or APPR mode switch and observe steering bar indicates turn torward the VOR needle.

NOTE

If the Omni Bearing Selector is more than 45° from the aircraft heading, the flight director steering bar will only indicate a turn toward the omni bearing.

(f) IN-FLIGHT PROCEDURE - FLIGHT DIRECTOR
(1) Century 41 circuit breaker - IN. Flight director switch - ON.
(2) Adjust HDG bug to aircraft heading and select desired pitch attitude by activation of the CWS (Pitch Synch) switch or the modifier switch.
(3) Maneuver aircraft manually to satisfy the commands presented. Select other modes as desired; refer to Century 41 Operator's Manual for mode description.

(g) IN-FLIGHT PROCEDURE - AUTOPILOT/FLIGHT DIRECTOR AUTOPILOT
(1) Flight director switch - ON, if F/D equipped. Rotate heading bug to desired heading.
(2) Trim aircraft for existing flight condition (all axes). Engage autopilot.
(3) During maneuvering flight-control aircraft through use of the HDG bug and the pitch modifier. (HDG-ATT modes) (For use of pitch synch switch see Operator's Manual.)
(4) For navigation operations select modes as required by the operation being conducted and in accordance with the mode description provided in Operator's Manual. For specific instructions relating to coupled instrument approach operations, refer to Special Operations and Information Section 4 item (i).

(h) IN-FLIGHT PROCEDURE - COMMAND/AUTOTRIM SYSTEM
(1) Trim master switch - ON.
(2) When the autopilot is engaged, pitch trim is accomplished and maintained automatically.
(3) With the autopilot OFF, command trim is obtained by pressing and rocking the combination TRIM-AP disconnect bar on the pilot's control wheel trim switch.

(i) SPECIAL OPERATIONS AND INFORMATION
(1) Altitude Hold Operation:
For best results, reduce rate of climb or descent to 1000 FPM before engaging altitude hold mode.
(2) Instrument Approach Operations:
Initial and/or intermediate approach segments should be conducted between 95-110 KIAS with a maximum of one notch (10°) flaps extended as desired. Upon intercepting the glide path or when passing the final approach fix (FAF) immediately lower the landing gear and reduce the power for approximately 90-95 KIAS on the final approach segment. Adjust power as necessary during remainder of approach to maintain correct airspeed. Monitor course guidance information (raw data) throughout the approach. All power changes should be of small magnitude and smoothly applied for best tracking performance. Do not change aircraft configuration during approach while autopilot is engaged. For approaches without glide path coupling, adjust pitch attitude in conjunction with power to maintain desired airspeed and descent rate.

NOTE

Flight director or autopilot will not decouple from the GS or localizer in the event of radio failure, however, warnings will flash in the mode appropriate to the failure. Monitor course guidance raw data during the approach to assure signal quality.

(3) Instrument Approach Go-Around Maneuver (Flight Director Version Only):
   a. Select GA mode at the remote GA switch. Autopilot will disconnect and warning horn will sound.
   b. Add takeoff power, or power as desired.
   c. Check the correct attitude and that a positive rate of climb is indicated, then raise gear and flaps.
   d. Pilot may hand fly aircraft with reference to flight director steering information.
   e. After aircraft is established in climb, gear and flaps up, autopilot may be re-engaged by pushing "ON" button on console if flight director steering is switched on.
   f. Set desired HDG and select HDG mode for lateral maneuvering.

SECTION 5 - PERFORMANCE

No changes to the basic performance provided by Section 5 of this Pilot's Operating Handbook are necessary for this supplement.

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PILOT'S OPERATING HANDBOOK AND FAA APPROVED AIRPLANE FLIGHT MANUAL

SUPPLEMENT NO. 19 FOR BENDIX RDR-160XD/IN-232A WEATHER RADAR SYSTEM

SECTION 1 - GENERAL

This supplement supplies information necessary for the operation of the airplane when the optional Bendix RDR-160XD/IN-232A Weather Radar System is installed in accordance with "FAA Approved" Piper data. The information contained within this supplement is to be used in conjunction with the complete handbook.

This supplement has been "FAA Approved" and must remain in this handbook at all times when the optional Bendix RDR-160XD/IN-232A Weather Radar System is installed.

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SECTION 2 - LIMITATIONS

No changes to the basic limitations provided by Section 2 of this Pilot's Operating Handbook are necessary for this supplement.

SECTION 3 - EMERGENCY PROCEDURES

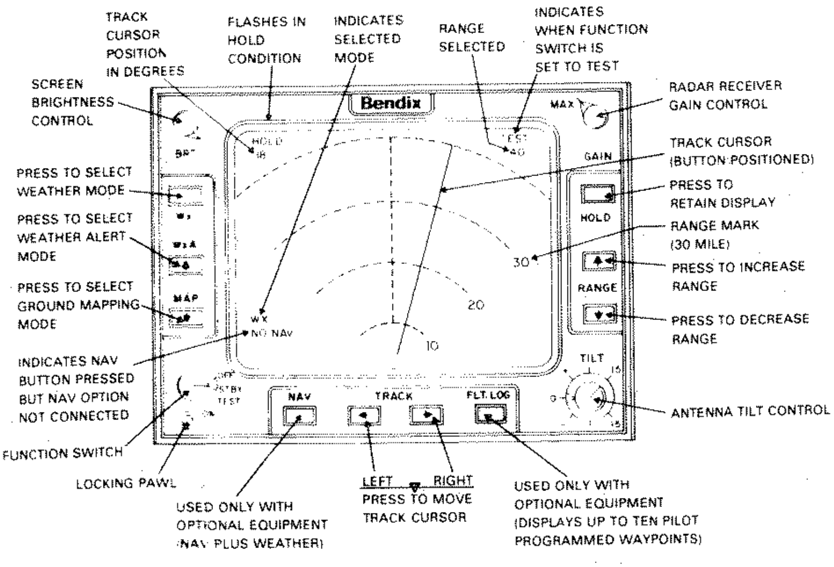
No changes to the basic Emergency Procedures provided by Section 3 of this Pilot's Operating Handbook are necessary for this supplement.

SECTION 4 - NORMAL PROCEDURES

(a) EQUIPMENT OPERATION AND CONTROLS

(1) RDR-160XD/IN-232A CONTROLS AND DISPLAYS

Controls and displays for the RDR-160XD/IN-232A Weather Radar System are listed in Table 4-3, with a functional description. Location of the controls and displays is shown in Figure 4-1. All operating controls and displays are located on the indicator.



IN-232A CONTROLS AND DISPLAYS
Figure 4-1

CONTROL/ DISPLAY	FUNCTION
Function selector	1. OFF position removes primary power from the system. 2. STBY position places system in the standby condition during warm-up period and when the system is not in use. No display. 3. TEST position selects test function to determine operability of the system. A test pattern is displayed. NO transmission exists in the TEST condition. 4. ON position selects the condition for normal operation. Radar transmission exists in the ON position.
[↓] RANGE button	Clears the display and places the indicator in the next lower range each time the button is pressed (eg: 40 to 20), until minimum range is reached.
TILT control	Electrically adjusts the antenna to move the radar beam up to +15 degrees above the horizontal, or to a maximum of -15 degrees below the horizontal position. The horizontal position is indicated as zero degrees on the control.
TRACK [→] button	When pressed, a yellow track cursor line appears and moves to the right (in one degree steps) while the button is held depressed. The track cursor stops when the button is released, and remains for about 10 to 15 seconds, then disappears unless the button is pressed again. The differential heading will be indicated in yellow numerals in the upper left corner of the display, and disappears simultaneously with the track cursor.

CONTROL/DISPLAY FUNCTIONS
Table 4-3

CONTROL/ DISPLAY	FUNCTION
TRACK [←] button	When pressed, the yellow track cursor appears and moves to the left while held depressed. Operation is as explained above.
GAIN control	Varies the radar receiver gain when in the MAP mode. Gain and the STC are preset in TEST function and in the WX and WXA modes.
BRT control	Adjusts brightness of the display for varying cockpit light conditions.
NAV button (push-on/push-off)	Operational only when optional IU-2023A Remote Computer Unit is connected. When actuated, provides NAV information superimposed over the MODE selected (WX, WXA, or MAP). If interface is not connected, the words NO NAV will be displayed in the lower left corner.
[↑] RANGE button	Clears the display and advances the indicator to the next higher range each time the button is pressed (eg: 20 to 40, 40 to 80, etc.), until 240 mile range is reached. The range selected is displayed in the upper right corner (on the last range mark), and the distance to each of the other range marks circles is displayed along the right edge of the circles (arcs).

CONTROL/DISPLAY FUNCTIONS (cont)
Table 4-3 (cont)

CONTROL/ DISPLAY	FUNCTION
HOLD pushbutton (push-on/push-off)	Retains the display (NAV and weather) when button is actuated (push-on). The word HOLD flashes in the upper left corner of the display. The weather or ground mapping image last presented is retained (frozen) on indicator display in order to evaluate the significance of storm cell movement. Switching back to normal operation (pressing HOLD pushbutton a second time) reveals direction and distance of target movement during HOLD period. In HOLD, the antenna continues to scan and a non-updated display will continue to be presented as long as power is supplied to the system. A change in range selection, with indicator in HOLD results in a blank screen.
Wx pushbutton	Selects the weather mode (Wx) when pressed. Pushbutton switch returns to normal position when released. "WX" appears in display.
WxA pushbutton (push-on/push-off)	Selects weather alert mode (WxA) when pressed. Red area flashes. Returns to previous mode (Wx or MAP) upon push-off.
MAP pushbutton	Selects ground mapping mode (MAP) when pressed. Mechanical operation same as Wx.
FLT LOG pushbutton	Operational only when optional NAV equipment is connected. When actuated, will display the flight log information stored in the optional NAV programmer. Ten waypoints and course information may be displayed (e.g., from NP-2041A). If a Remote Computer Unit is not connected, the words "NO LOG" appear in the lower left corner.

CONTROL/DISPLAY FUNCTIONS (cont)
Table 4-3 (cont)

(b) OPERATING PRECAUTIONS

WARNING

Do not operate the radar during refueling operations or in the vicinity of trucks or containers accommoding flammables or explosives. Do not allow personnel within 15 feet of area being scanned by antenna when system is transmitting.

(1) Flash bulbs can be exploded by radar energy.
(2) Since storm patterns are never stationary, the display is constantly changing. Continued observation is always advisable in stormy areas.

SECTION 5 - PERFORMANCE

No changes to the basic performance provided by Section 5 of the Pilot's Operating Handbook are necessary for this supplement.

PILOT'S OPERATING HANDBOOK
AND
FAA APPROVED AIRPLANE FLIGHT MANUAL

SUPPLEMENT NO. 20
FOR
EDO-AVIONICS COMMAND ELECTRIC TRIM SYSTEM
MODEL AK923

SECTION 1 - GENERAL

This supplement is to acquaint the pilot with the operation of the EDO-Avionics Command Electric Trim System Model AK923 as installed in the PA-34-220T Seneca III in accordance with "FAA Approved" Piper data. The airplane must be operated within the limitations herein specified.

This supplement has been "FAA Approved" based on EDO-Avionics STC SA3422SW-D and must remain in this handbook at all times when the optional EDO-Avionics Command Electric Trim System Model AK923 is installed.

FAA APPROVED ________________________________
WARD EVANS
D.O.A. NO. SO-1
PIPER AIRCRAFT CORPORATION
VERO BEACH, FLORIDA

SECTION 2 - LIMITATIONS

(a) Placards

In full view of pilot:

CONDUCT TRIM CHECK PRIOR TO FLIGHT

SECTION 3 - EMERGENCY PROCEDURES

(a) AUTOPILOT MALFUNCTION
- (1) Overpower control wheel forces initially, and depress and hold the master interrupt switch on the control wheel. This will stop all trim action.
- (2) Retrim aircraft with manual trim system to alleviate control force.
- (3) Move the trim master switch to the OFF position.
- (4) Release interrupt switch while observing trim wheel to assure that the trim system is disabled.
- (5) Pull trim circuit breaker. Leave circuit breaker open until the trim system is corrected.

SECTION 4 - NORMAL PROCEDURES

(a) PRE-FLIGHT INSPECTION - BEFORE EACH FLIGHT
- (1) Circuit breaker - IN.
- (2) Trim master switch - ON.
- (3) Depress switch center bar and rock switch fore (down) and aft (up) - check that trim operates in correct direction both Up and Down.
- (4) Release trim switch. Depress only the center bar - Trim should not operate.
- (5) Rock switch fore and aft only - (Do not depress center bar.) Trim should not operate.
- (6) Operate trim normally - grasp trim wheel and check that trim may be overpowered by hand.
- (7) Operate trim Up or Down - Depress Interrupt Switch - Check that trim action stops.

If the trim system fails any portion of the above check procedures, turn the trim master switch OFF and do not operate the trim system until the system is corrected. This trim system has been designed to require two separate failures before uncontrolled operation can occur. The pre-flight inspection procedure is established to identify a system failure that might otherwise go undetected.

(b) IN-FLIGHT PROCEDURES

Depress center bar and move switch rocker fore or aft to obtain electric trim nose down or up. Release switch to stop trimming.

SECTION 5 - PERFORMANCE

No changes to the basic performance provided by Section 5 of this Pilot's Operating Handbook are necessary for this supplement.

SECTION 6 - WEIGHT AND BALANCE

Factory installed optional equipment is included in the delivered weight and balance data in Section 6 of the basic Pilot's Operating Handbook.

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PILOT'S OPERATING HANDBOOK AND FAA APPROVED AIRPLANE FLIGHT MANUAL

SUPPLEMENT NO. 21 FOR CENTURY 31 AUTOPILOT MODEL AK895

This supplement must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when the Century 31 Autopilot System Model AK895 is installed in accordance with STC SA3390SW-D. The information contained herein supplements or supersedes the information in the basic Pilot's Operating Handbook and FAA Approved Airplane Flight Manual only in those areas listed herein. For limitations, procedures and performance information not contained in this supplement, consult the basic Pilot's Operating Handbook and FAA Approved Airplane Flight Manual.

FAA APPROVED Ward Evans
WARD EVANS
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PIPER AIRCRAFT CORPORATION
VERO BEACH, FLORIDA

DATE OF APPROVAL February 10, 1984

SECTION 1 - GENERAL

This supplement supplies information necessary for the operation of the airplane when the optional Century 31 Autopilot Model AK895 is installed in accordance with "FAA Approved" Piper data.

SECTION 2 - LIMITATIONS

(a) Autopilot OFF during takeoff and landing.
(b) Maximum airspeed for autopilot operation is 180 KIAS.
(c) Autopilot operation prohibited with more than 2 notches (25°) flaps extended.
(d) Autopilot coupled single-engine approaches to be conducted at 90 KIAS or faster, with flaps up.
(e) Category I operations only.
(f) Placard - in full view of the pilot:

CONDUCT TRIM CHECK
PRIOR TO FIRST FLIGHT
OF DAY (SEE AFM).

SECTION 3 - EMERGENCY PROCEDURES

(a) AUTOPILOT
In the event of an autopilot malfunction, or anytime the autopilot is not performing as commanded, do not attempt to identify the problem system. Regain control of the aircraft by overpowering and immediately disconnecting the autopilot. Be prepared for any residual trim force and retrim, as necessary, using the aircraft's primary trim control.

CAUTION

Do not overpower autopilot in pitch for more than approximately 3 seconds as the autotrim system will cause an increase in pitch overpower forces.

(1) Autopilot may be disconnected by:
   a. Pressing "AP OFF" bar on pilot's trim switch.
   b. Pressing the AP ON-OFF switch on the programmer OFF.
   c. Depressing Master Disconnect Trim Interrupt switch.
   d. Pulling the AP System Circuit breaker OFF.

(2) Autotrim may be disconnected by:
   a. Any action in (1) above, or
   b. Pulling the trim system circuit breaker OFF.

   After failed system has been identified, leave system circuit breaker open and do not operate until the system failure has been identified and corrected.

(3) Altitude Loss During Malfunction:
   a. An autopilot malfunction during climb, cruise or descent with a 3 second delay in recovery initiation could result in as much as 60° of bank and 500 foot altitude loss. Maximum altitude loss was recorded at 180 KIAS during descent.
   b. An autopilot malfunction during an approach (single engine, gear down, flaps up) with a 1 second delay in recovery initiation could result in as much as 18° bank and 120 foot altitude loss.

(4) Single Engine Operations:
   a. Engine failure during approach operation: Disengage autopilot, conduct remainder of approach manually.
   b. Engine failure during climb, cruise or descent: Retrim aircraft, perform aircraft engine inoperative procedures.
   c. Maintain aircraft Yaw Trim throughout all single engine operations, either by aircraft rudder trim or manual rudder application.

(b) COMPASS SYSTEM

(1) Emergency Operation with Optional NSD 360A (HSI) Slaved and or Non-Slaved:
   a. Appearance of HDG Flag:
      1. Check air supply gauge (vac or pressure) for adequate air supply (4.2 in. Hg. min.).
      2. Check compass circuit breaker.
      3. Observe display for proper operation.

b. To disable heading card - pull circuit breaker and use magnetic compass for directional data.

NOTE

If heading card is not operational, autopilot should not be used.

c. With card disabled VOR/Localizer and Glide Slope displays are still functional; use card set to rotate card to aircraft heading for correct picture.
d. Slaving Failure - (i.e. failure to self correct for gyro drift):
   1. Check gyro slaving switch is set to No. 1 position (if equipped with Slave No. 1 - No. 2 switch) or SLAVED position when equipped with Slaved and Free Gyro Mode Switch.
   2. Check for HDG Flag.
   3. Check compass circuit breaker.
   4. Reset heading card while observing slaving meter.

NOTE

Dead slaving meter needle or a needle displaced fully one direction indicates a slaving system failure.

   5. Select slaving amplifier No. 2, if equipped.
   6. Reset heading card while checking slaving meter. If proper slaving indication is not obtained, switch to free gyro mode and periodically set card as an unslaved gyro.

NOTE

In the localizer mode, the TO FROM arrows may remain out of view, depending upon the design of the NAV converter used in the installation.

SECTION 4 - NORMAL PROCEDURES

(a) PREFLIGHT PROCEDURES

NOTE

During system functional check the system must be provided adequate D.C. voltage (14.0 VDC min.) and instrument air (4.2 in. Hg. min.). It is recommended that the engine(s) be operated to provide the necessary power and that the aircraft be positioned in a level attitude. during the functional check.

(1) AUTOPILOT AUTOTRIM - To be performed before the first flight of each day.

a. Trim system switch - on.
b. Engage autopilot.
c. Move the heading bug left and right of the lubber line. Observe that the control wheel moves in the direction of the heading bug displacement.
d. Press the DN switch - verify that the control wheel moves in the down direction. Verify that after approximately a 3 second delay, the trim moves in the down direction.
e. Press the UP switch - verify that the control wheel moves in the up direction. Verify that after approximately a 3 second delay, the trim moves in the up direction.
f. Grasp control wheel and override roll and pitch servo actuators to assure override capability.
g. Hold control yoke and disengage autopilot by activating the AP OFF switch on the control wheel.
h. Check controls through full travel in roll and pitch to assure complete autopilot disengagement.
i. Press and hold the TEST switch - all mode annunciators light with AP flashing.
j. Release the TEST switch after all annunciator lights except HDG, ATT, and TEST turn off.
k. Press Pitch Modifier switch DN then UP - HDG, ATT, and TEST remain on.
l. Momentarily press the TEST switch - HDG and ATT remain on, TEST flashes.

m. Press Pitch Modifier switch DN then UP - the TEST light remains off as long as the switch is held.
n. Momentarily press the TEST switch - HDG and ATT lights remain on and the TEST light turns off.

(2) COMMAND TRIM SYSTEM - To be performed before the first flight of each day.
a. Using the control wheel trim switch, verify normal trim up and down operation.
b. Press and hold the center bar on the control wheel trim switch. Observe that the trim system does not operate.
c. Release the center bar on the control wheel trim switch. Move the control wheel trim switch fore and aft. Observe that the trim system does not operate.

This completes the test sequences.

CAUTIONS

Any failure of the above procedures indicates that a failure exists in the system and the system shall not be operated until the failure has been located and corrected.

Check the elevator trim position before takeoff.

(3) COMPASS SYSTEM (NSD 360A)
(For other compass systems, refer to appropriate manufacturer's instructions)
a. Check slaving switch in SLAVE or No. 1 or No. 2 position, as appropriate. (Slaving systems with R.M.I. output provides only slave and free gyro positions.)
b. Rotate card to center slaving meter - check HDG (Heading) displayed with magnetic compass heading.
c. Perform standard VOR receiver check.

(b) IN-FLIGHT PROCEDURE - AUTOPILOT
(1) Rotate heading bug to desired heading.
(2) Trim aircraft for existing flight condition (all axes). Engage autopilot.
(3) During maneuvering flight - control aircraft through use of the heading bug and the pitch modifier. (HDG-ATT modes)

(4) For navigation operations select modes as required by the operation being conducted and in accordance with the mode description provided in Section 7.1. For specific instructions relating to coupled instrument approach operations, refer to Special Operations and Information.

(c) IN-FLIGHT PROCEDURE - COMMAND AUTOTRIM SYSTEM

(1) When the autopilot is engaged, pitch trim is accomplished and maintained automatically.

(2) With the autopilot OFF, command trim is obtained by pressing and rocking the combination TRIM-AP disconnect bar on the pilot's control wheel trim switch.

(d) SPECIAL OPERATIONS AND INFORMATION

(1) Altitude Hold Operation
For best results, reduce rate of climb or descent to 1000 FPM before engaging altitude hold mode.

(2) Instrument Approach Operations
Initial and/or intermediate approach segments should be conducted between 90-109 KIAS with up to 2 notches (25°) flap selected if desired. Upon intercepting the glide path or when passing the final approach fix (FAF) immediately lower the landing gear and reduce the power for approximately 90 KIAS on the final approach segment. Adjust power as necessary during remainder of approach to maintain correct airspeed. Monitor course guidance information (raw data) throughout the approach. All power changes should be of small magnitude and smoothly applied for best tracking performance. For optimum performance do not change aircraft configuration during final approach while autopilot is engaged. For approaches without glide path coupling, adjust pitch attitude in conjunction with power to maintain desired airspeed and descent rate. Proper rudder trim must be maintained throughout the approach to insure maximum tracking quality.

NOTE

The autopilot will not decouple from the GS or localizer in the event of radio failure, however, warnings will flash in the mode appropriate to the failure. Monitor course guidance raw data during the approach to assure signal quality.

(3) Instrument Approach Go-Around Maneuver
   a. Disconnect the autopilot and manually control the aircraft.
   b. Add takeoff power, or power as desired.
   c. Check that correct attitude and a positive rate of climb is indicated, then raise gear and flaps.
   d. Set the heading bug to the desired missed approach heading.
   e. Re-engage the autopilot.

SECTION 5 - PERFORMANCE

No change.

SECTION 6 - WEIGHT AND BALANCE

Factory installed optional equipment is included in the licensed weight and balance data in Section 6 of the basic Pilot's Operating Handbook.

SECTION 7 - DESCRIPTION AND OPERATION

The Century 31 Autopilot is a light weight electronic autopilot system utilizing vertical and directional gyro signals and D.C. electric servos to provide three axis sensing and two surface control. The system includes lateral and vertical radio coupling, command and automatic elevator trim; and navigation and autopilot failure monitor and warning systems.

The Century 31 is activated with the aircraft master switch and operates in a low power state until the autopilot is engaged. Mode selection is made by pushing the desired mode switch on the mode programmer. The selected mode will illuminate on the annunciator panel.

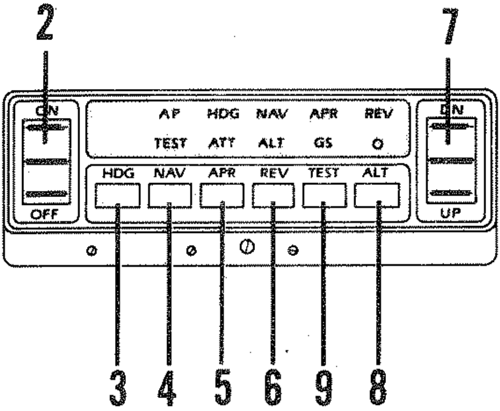
The annunciator panel contains an ambient light level sensor which will automatically dim the annunciator light level during night operations. The programmer contains mode recognition lights and dimming is provided by the panel light dimmer switch.

The electric elevator trim system is a fully redundant type in both the manual and autotrim modes. The trim system is powered through a separate system master switch that must be "ON" during autopilot operations, and for the control wheel trim command switch to function when the autopilot is OFF.

WARNING

Several comments are made throughout this supplement about warnings being flashed in NAV APR REV and GS modes in the event valid NAV or GS signal is lost. This is true only if the aircraft is equipped with navigation and glide slope receivers that have external warning flag pickoffs. Pilot should monitor raw data at all time to insure flight safety when the autopilot is engaged.

7.1 COCKPIT CONTROLS AND FUNCTIONS



CONTROLLER/FLIGHT COMPUTER
Figure 7-1

1. Trim Control Wheel Switch - on autopilot control wheel switch cap (Figure 7-3) - provides power for all autotrim and control wheel electric trim operations.
2. Autopilot ON - OFF Switch - Momentary rocker type switch which engages or disengages the autopilot roll, pitch and trim servos and lights or extinguishes autopilot (AP) annunciator, as appropriate.

NOTE

The autopilot will switch to HDG and ATT modes upon engagement or disengagement with automatic pitch attitude synchronization.

3. HDG Mode Selector Switch - provides turn control and heading hold through use of the heading index (bug) on the D.G. or H.S.I. heading instrument.

Figure 7-1 (cont)

4. NAV (Navigation) Mode Selector Switch - provides automatic 45° VOR-LOC intercept angle; tracking and crosswind correction. The autopilot utilizes the HDG bug as the VOR course reference and a separate VOR indicator instrument for left-right information when using a D.G. or the course indicator and left-right needle for reference inputs when using an H.S.I. type compass, VOR display. The NAV mode provides automatic gain and rate reductions and bank limiting to improve tracking performance. NAV mode should normally be used as an enroute function. Select APR mode for LOC and VOR approaches.

NOTES

1. The heading bug is disabled when using an H.S.I. and NAV, APR or REV is selected, except when using selected angle intercept feature (refer to Special Modes and Operations).
2. With a D.G., the heading bug must be set to the desired radio course when using NAV, APR or REV modes.

Select desired course on H.S.I. course selector (or OBS and D.G.) and select NAV mode for VOR tracking.

5. APR (Approach) Mode Selector Switch - provides automatic 45° VOR-LOC intercept angle, tracking and crosswind correction during instrument approach operations. D.G. H.S.I. operation and function are identical to NAV mode. Select the desired course on H.S.I. (or O.B.S. and D.G.) course selector and select APR mode.
6. REV (Back Course) Mode Selector Switch - for use in tracking the LOC front course outbound, or the LOC back course inbound, or the published VOR approach course outbound. When using an H.S.I. display always set the course selector on the inbound front localizer course or VOR inbound published approach course when using REV mode. When using a D.G. the heading bug must be set to the final approach course.
7. Pitch Modifier/Attitude Selector Switch
The pitch data modifier is a momentary type switch that is used to select the ATT mode or modify the aircraft attitude. When the autopilot is engaged, automatic pitch synchronization is provided to the attitude existing at engagement. In ATT mode, actuation of the modifier UP or DN will cause a pitch attitude change at a rate of

Figure 7-1 (cont)

.7° per second. In ALT mode, actuation of the pitch modifier will cause the autopilot to enter the ATT mode with subsequent operation as described above.

8. ALT (Altitude) Mode Selector Switch
Selection of ALT mode will cause the autopilot to maintain the pressure level (altitude) at the point of engagement. Because of the pitch rate control provided by the autopilot, altitude mode may be engaged from any rate of climb or descent, however, for maximum passenger comfort, rate of climb or descent should be reduced to 1000 FPM or less prior to ALT mode engagement.
9. Test - See Section 4 for test procedures.

(a) SPECIAL MODES AND OPERATIONS

(1) Glide Slope (GS) Mode - The GS mode is fully automatic, therefore, no GS engage switch is used. The GS mode may be entered from either ATT mode or ALT mode, from above the GS centerline or below the centerline.

Activation of the GS mode depends upon satisfying two sets of conditions: completion of the ARMING sequence and the satisfying of an equation relating to the aircraft's position relative to the GS centerline and the rate at which the aircraft is approaching or departing from the GS centerline.

For GS mode arming, the following conditions must exist simultaneously:

a. No. 1 NAV radio must be channeled to a localizer frequency.
b. Localizer deviation must be less than 80%.
c. Localizer flag not extended - valid LOC signal.
d. GS Flag not extended - valid GS signal.
e. System in APR mode.
f. System in either ATT or ALT mode.

When the GS mode arming conditions are met, the GS mode annunciator will illuminate in conjunction with the active pitch mode. Loss of any arming condition prior to GS capture will cause the GS annunciator to extinguish.

GS mode activation (GS capture) is indicated by the active pitch mode annunciator extinguishing, leaving only the GS annunciator lighted. Since GS mode activation results from a combination of position and rate information, GS capture will probably occur before the GS needle centers in such a manner that the transition on to the GS centerline will be anticipated and therefore, very smooth.

After GS capture, loss of valid GS signal will cause the GS annunciator to flash. Also selection of HDG, NAV or REV mode will cause GS to flash, indicating an inconsistent GS tracking condition. APR mode must be selected while tracking glide slope.

The GS mode may be deactivated by selection of any other pitch mode (ATT, ALT), however, automatic reactivation is possible from any pitch mode if APR mode is selected.

NOTE

If valid glide slope data is lost after coupling, the autopilot will NOT automatically decouple, however the GS light will flash. The pilot must monitor raw course guidance data during the approach to assure signal quality.

Since GS arm and capture are automatic when the arming and capture sequence is met, the GS must be locked out for holding operations on the localizer at the L.O.M. When localizer holding is desired, localizer tracking must be performed in NAV mode which will offer the same tracking dynamics as APR mode but will inhibit GS arm and capture. When APR clearance is received, select APR mode for completion of the approach.

(2) Selected Angle Intercepts - If an H.S.I. type heading system is installed, selected angle intercepts may be made during VOR or localizer intercept situations by selecting HDG and NAV, HDG and APR, or HDG and REV, simultaneously, as appropriate. During a selected angle intercept operation, the autopilot will follow the heading bug until reaching the computed On Course Turn Point at which time capture is indicated by extinguishing of the HDG mode annunciator. Selected angle intercepts of over 60° are not recommended.

NOTE

If radio information becomes invalid (Flag) after initiation of a selected angle intercept the applicable navigation mode annunciator will flash and the autopilot will remain in HDG mode. The automatic mode shift to the invalid radio mode will not occur.

(3) CWS Mode - The system is equipped with a control wheel steering switch on the pilot's control wheel. When depressed and held, this switch will disengage the autopilot roll and pitch servos to allow manual aircraft maneuvering. When released, the servos will re-engage with the lateral (roll) mode previously in use activated. The pitch mode previously engaged will remain programmed in the following condition:
   a. ALT Mode - If ALT mode had been in use, the ALT mode will synchronize at the new pressure altitude existing at release of the CWS switch.
   b. ATT Mode - If the ATT mode had been in use, the system will synchronize with the aircraft attitude existing at release of the switch.

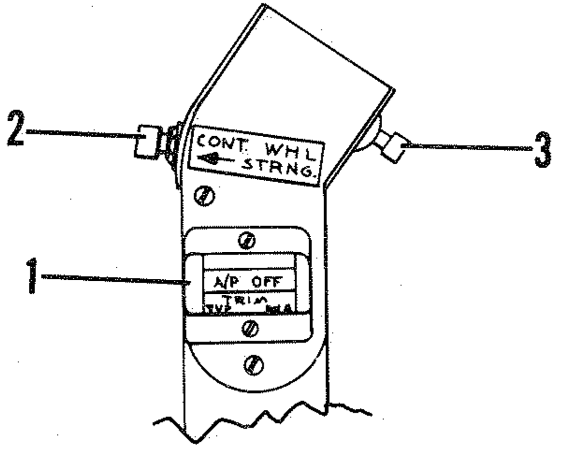
(4) System Test (Ground Operations Only) - The system is equipped with a comprehensive test circuit which, when activated, will test the failure monitor circuits and all the annunciator lamps. Activation of the TEST switch will initiate the system test only when the autopilot is NOT engaged. When autopilot is engaged, activation of the TEST switch will test the annunciator lamps. If the autopilot is engaged during the test sequence, the sequence will terminate immediately. Refer to Section 4 for tests required before the first flight of each day.

(5) Warning System and Interlocks - The Century 31 System includes a number of automatic interlocks that will prevent system operation or individual mode operation if the input information is not valid or if other prerequisite conditions do not exist. In addition to the interlocks, the system will annunciate various failure conditions as advisory information for the pilot. Following is a brief description of the interlocks and warnings provided.

a. Interlocks
   1. Autopilot engagement is inhibited unless an excitation signal is being provided to the attitude gyro.
   2. Selection of ALT mode is inhibited if the system altitude information is unreliable or if the entire system has not been powered for approximately 3 minutes to allow stabilization of the altitude source.
   3. During Dual Mode (selected angle) intercepts, if the navigation information becomes invalid the appropriate NAV/APR/REV annunciator will flash and automatic mode switching from HDG to the coupled navigation mode will be inhibited.

b. Warnings
   1. Low Voltage - When the aircraft bus voltage falls below the minimum required for reliable system function, any mode annunciator not already ON will flash.
   2. Attitude Gyro Excitation - Absence of valid gyro excitation will cause the autopilot to disengage and the AP annunciator to flash. The autopilot cannot be re-engaged until this condition is corrected.
   3. AP Disengagement - Anytime the autopilot is disengaged the AP annunciator will flash for approximately 5 seconds, then remain OFF.
   4. Navigation Information Invalid - The appropriate navigation mode annunciator will flash when selected and invalid navigation signals are present (NAV Flag in view). Additionally, the appropriate navigation mode annunciator (NAV/APR/REV) will flash during a dual mode intercept if invalid navigation information is present.
   5. GS Information Invalid - The GS annunciator will flash when GS information (GS Flag in view) is invalid after the GS mode is active or when HDG, NAV or REV mode is selected after GS capture. If valid GS information is not available during the arming sequence, the system will not arm and GS capture will not occur.

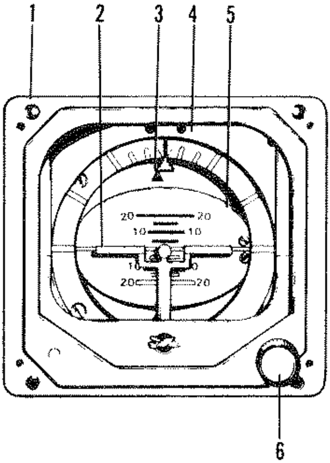
(b) REMOTE CONTROL SWITCHES



AUTOPILOT CONTROL WHEEL SWITCH CAP
Figure 7-3

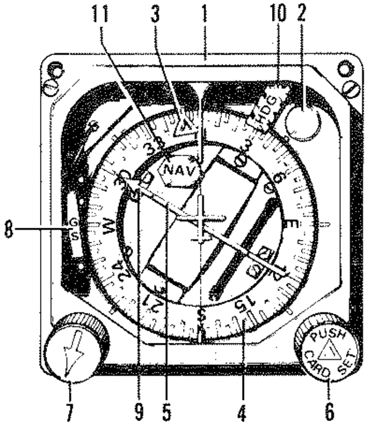
(1) Control Wheel Trim Switch - Dual action type switch requiring the top bar to be depressed and the rocker to be moved fore or aft to cause the electric trim to function from the control wheel switch. Depressing the center bar will disconnect the autopilot.
(2) Control Wheel Steering (CWS) Switch
See explanation in Special Modes and Operations Section.
(3) Master Disconnect Trim Interrupt Switch - Pressing this switch will disconnect autopilot and interrupt manual electric trim while held depressed. Trim operation will resume when the switch is released.

7.3 INSTRUMENTS



ATTITUDE GYRO
Figure 7-5

1. Standard 3 Inch Air Driven Attitude Indicator Gyro.
2. Symbolic Airplane - Serves as a stationary symbol of the aircraft. Aircraft pitch and roll attitudes are displayed by the relationship between the fixed symbolic aircraft and the movable background.
3. Roll Attitude Index - Displays airplane roll attitude with respect to the roll attitude scale.
4. Roll Attitude Scale - Scale marked at 0, ±10, ±20, ±30, ±60 and ±90 degrees.
5. Pitch Attitude Scale - Moves with respect to the symbolic airplane to present pitch attitude. Scale graduated at 0, ±5, ±10, ±15, ±20 degrees.
6. Symbolic Aircraft Alignment Knob - Provides manual positioning of the symbolic aircraft for level flight under various load conditions.



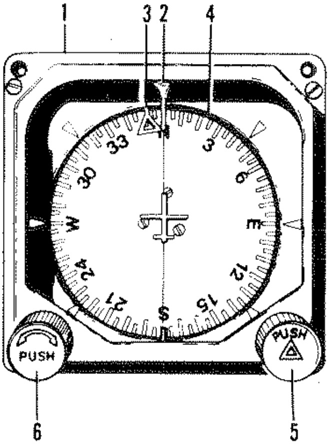
NSD-360A NAVIGATION SITUATION DISPLAY
Figure 7-7

1. NSD-360A Compass System - (For details of any other compass system, refer to manufacturer's information.)
2. Slaving Meter - Oscillation of needle indicates that compass is slaved to magnetic flux detector. Needle maintained in either extreme position for more than 2 - 3 minutes indicates system failure.

NOTE

NSD-360A System includes a slaving selector switch allowing the selection of free gyro mode. Refer to emergency procedures for failure instructions.

3. HDG index (bug) for autopilot heading control.
4. Compass card.
5. Left-right portion of VOR-LOC Course Needle.
6. HDG Control Knob - push in for initial compass setting.
7. VOR Course Needle Set Knob (O.B.S.).
8. GS Indicator with Flag Alarm.
9. VOR-LOC Bearing Selector Course Needle and Omni Bearing Indicator.
10. Heading Warning Flag.
11. Navigation Warning Flag.



DIRECTIONAL GYRO
Figure 7-9

1. Non-Slaved Directional Gyro - Provides a stable visual indication of aircraft heading to the pilot. The gyro is air driven.
2. Lubber Line - Indicates aircraft magnetic heading on compass card (4).
3. Heading Bug - Moved by (△) knob (5) to select desired heading.
4. Compass Card - Rotates to display heading of airplane with reference to lubber line (2) on DG.
5. Heading Selector Knob (△) - Positions heading bug (3) on compass card (4) by rotating the heading selector knob. The bug rotates with the compass card.
6. Gyro Adjustment Knob (PUSH) - When pushed in, allows the pilot to manually rotate the gyro compass card (4) to correspond with the magnetic heading indicated by the magnetic compass. The unslaved compass card must be manually reset periodically to compensate for precessional errors in the gyro.

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SECTION 10

SAFETY TIPS

Forms to be completed (Physiological Training Application and Agreement) for application for the training course may be obtained by writing to the following address:

Chief of Physiological Training, AAC-143
FAA Aeronautical Center
P. O. Box 25082
Oklahoma City, Oklahoma 73125

It is recommended that all pilots who plan to fly above 10,000 feet take this training before flying this high and then take refresher training every two or three years.

(l) Sluggish RPM control and propeller overspeed with poor RPM recovery after rapid throttle application are indications that nitrogen pressure in the propeller dome is low.

(m) Experience has shown that the training advantage gained by pulling a mixture control or turning off the fuel to simulate engine failure at low altitude is not worth the risk assumed, therefore, it is recommended that instead of using either of these procedures to simulate loss of power at low altitude, the throttle be retarded slowly to idle position. Fast reduction of power may be harmful to the engine. A power setting of 2200 RPM is recommended for simulated one engine operation.